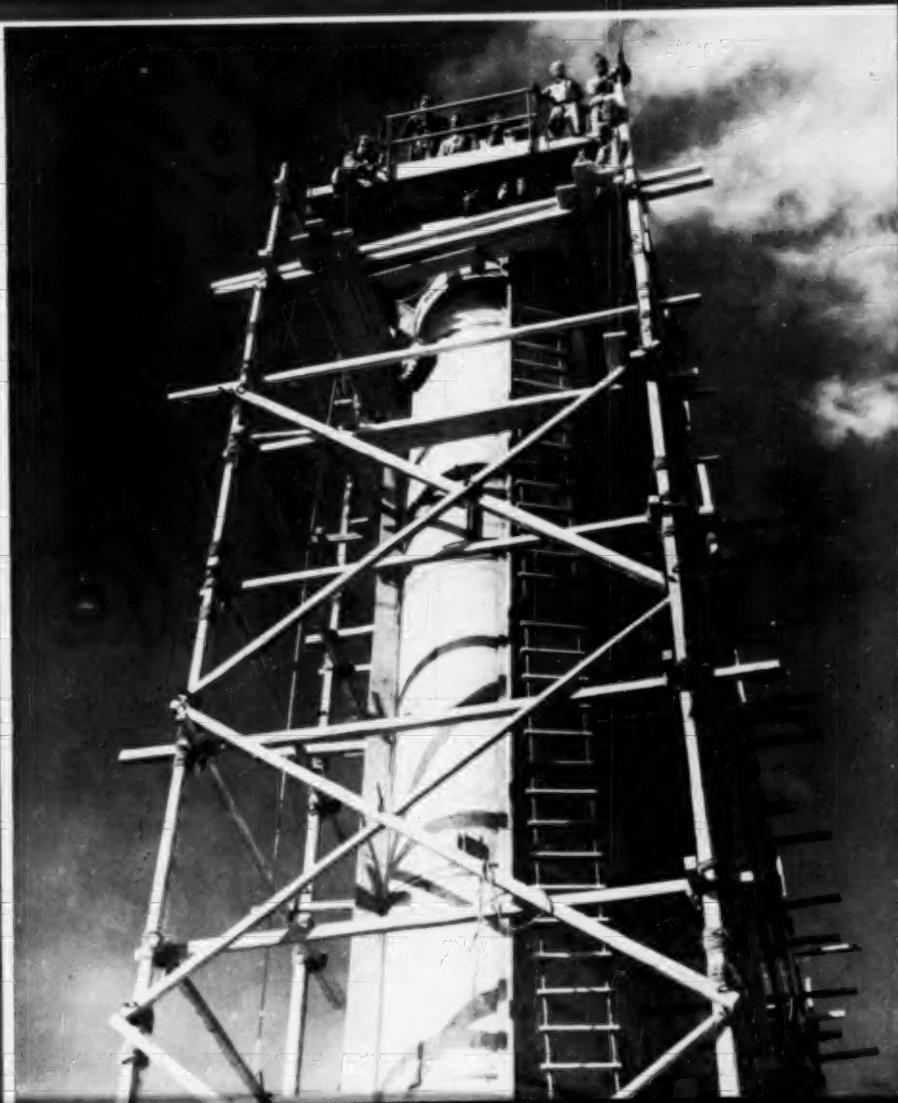


AGRICULTURAL CHEMICALS

In This Issue:

- Anti-Fertilizer Propaganda in England
- Tomato Insect Investigations
- Annual USDA Report on Fertilizer Consumption
- Petroleum and Outdoor Spraying
- Two Fertilizer Conferences Held This Month
- Insecticides Appear to be Short in 1950 Pest Season
- Colloidal Sulphur Suspension as Fertilizer in New Zealand



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THIS MONTH'S COVER

Construction of nitric acid absorption tower at new Egyptian fertilizer plant near Cairo. Note contrast of ancient with modern: scaffolding lashed together with rope; headgear worn by native workers; rope ladder leading to tower's top. Plant, however, is ultra modern, designed by Chemical Construction Corp., New York. (Photo courtesy Chemical Construction Corp.)

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VOL. V **No. 6**

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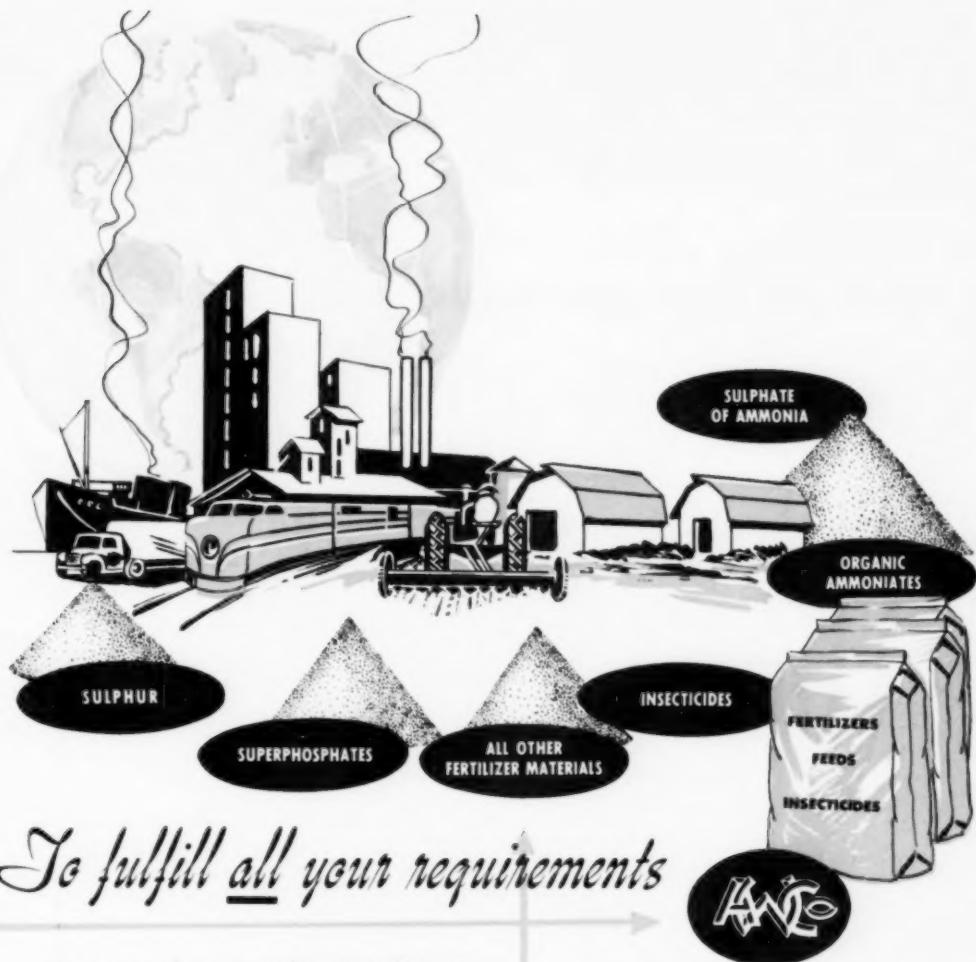
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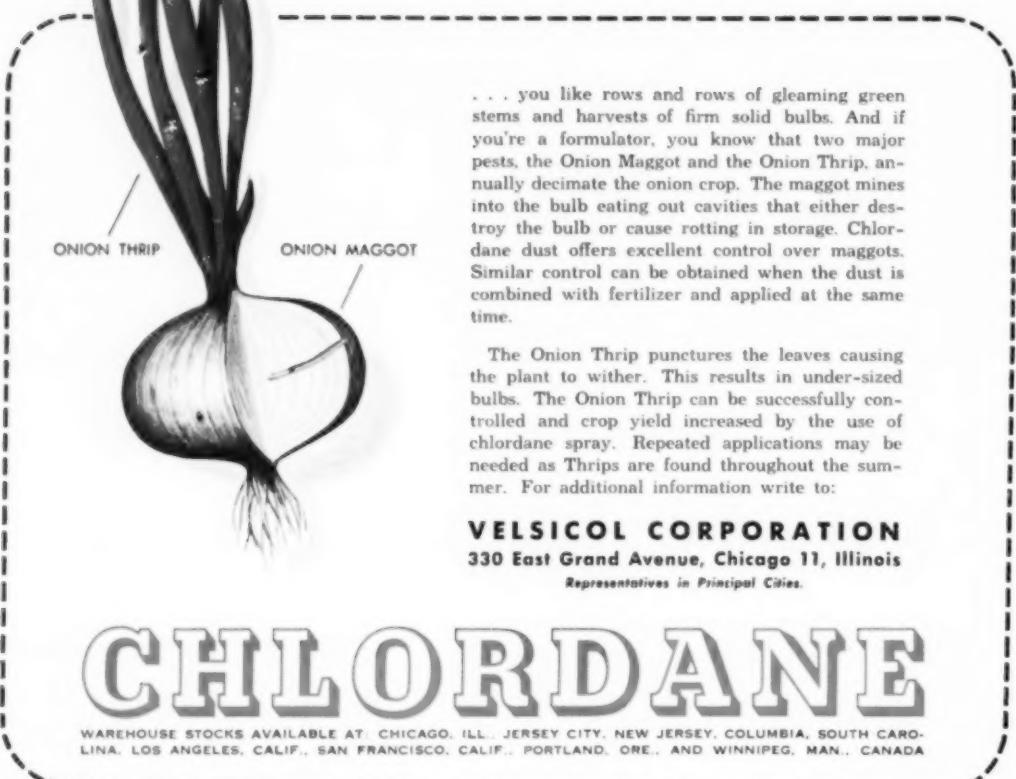
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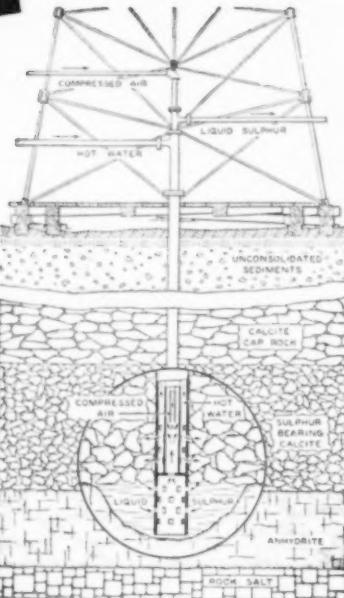
SULPHUR

*Interesting Facts Concerning This Basic Raw Material from the Gulf Coast Region

*WELL PIPING

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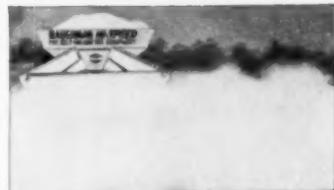


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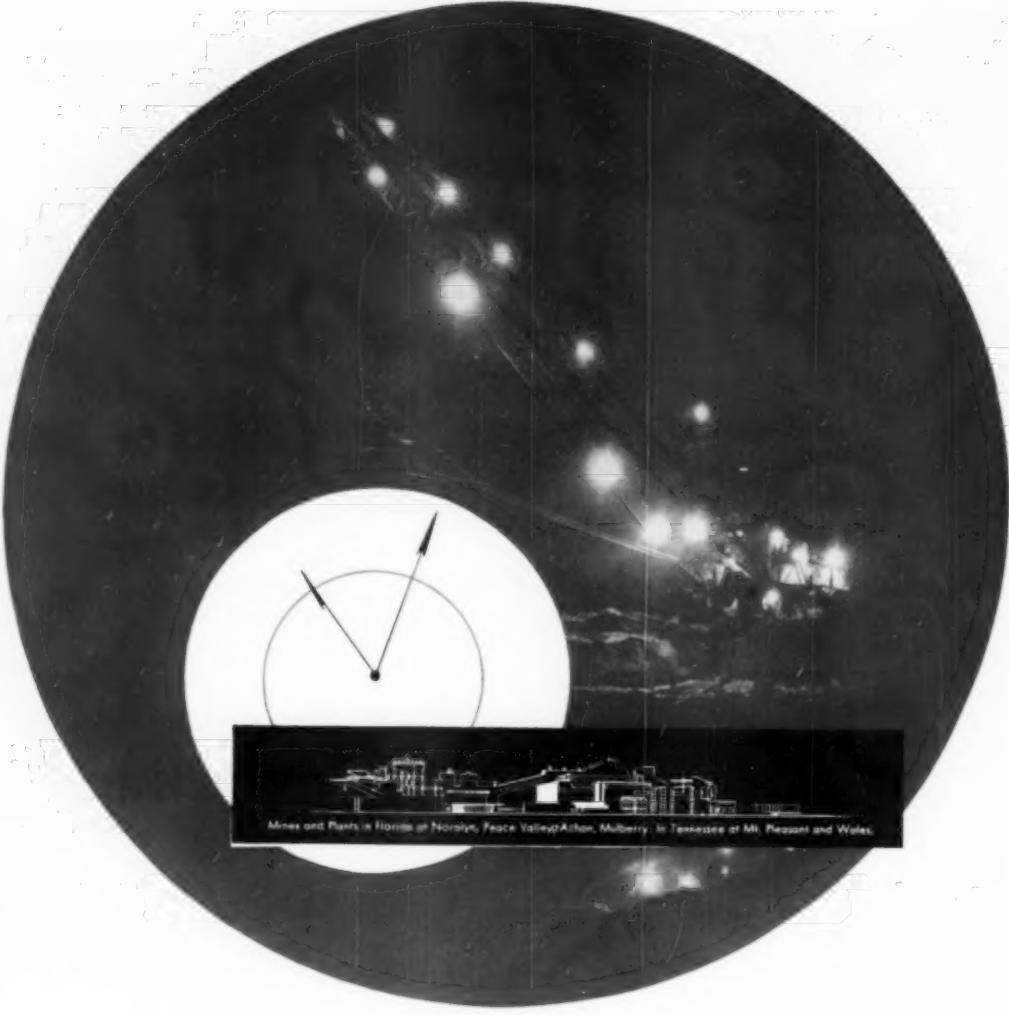
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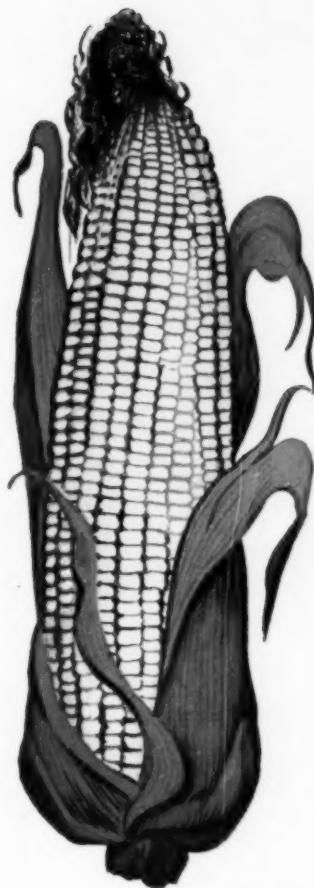
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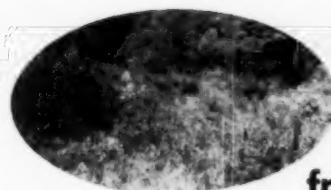
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from brush land to grass land



An abandoned field with eight-year-old brush cover of alder, birch, willow, aspen, blueberry, maple, and spiraea is shown. This can be converted into grass land, as shown here, *in one season* through proper use of Esteron Brush Killer and Esteron 245. The field illustrated at the right originally bore a brush cover similar to the field shown above.

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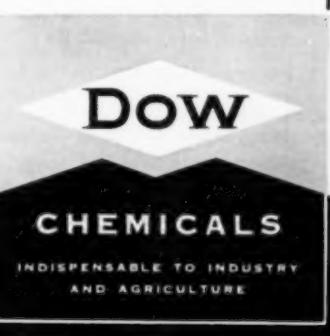
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NO ONE KNOWS exactly when prehistoric Americans first began to tame wild grasses and develop them into corn. But experts estimate that corn has been grown on this continent as a man-managed crop for at least 3,000 years.

By the time the first white men came to these shores, the Indians had developed the production and utilization of corn into a primitive science. They planted it in hills, fertilized it with fish, cultivated it with crude hoes, kept the harvested corn in cribs and ground it into meal.

USING THESE METHODS, the white colonists produced the "daily bread" which enabled them to settle America. And when the pioneers pushed westward, they carried the golden seed in their covered wagons. Indian corn was the foundation on which American agriculture was built.

Today corn is still America's No. 1 farm crop, as important to you as it was to the early Americans. 87,910,000 U.S. acres were planted to corn in 1949. The corn from these acres reaches you as meat, milk, eggs, cereals, meals, syrup, sugar, oil, industrial alcohol and countless things essential to your welfare.

THE ENDEAVOR to produce bigger yields of better quality corn through research, which started so many centuries ago, continues today. It is making great progress during your lifetime . . . with the development of hybrid seed, the improvement of farm machinery, the closer spacing of plants, and the new knowledge of the importance of heavy applications of nitrogen fertilizer.

For instance, the North Carolina Agricultural Experiment Station recently reported the results of 49 fertilizer experiments on corn, conducted over a five-year period. By adding large quantities of nitrogen to the fertilizer



program, the yield of corn was greatly increased. Where 120 pounds of nitrogen per acre was used, the average yield was 81 bushels, as compared to a yield of 28 bushels without the added nitrogen.

IN FERTILIZER TESTS at the Illinois Agricultural Experiment Station on excellent corn land, the yield was 184 bushels per acre where 160 pounds of nitrogen was used, as compared to a yield of 100 bushels without the added nitrogen. In these tests, nitrogen produced better quality corn with a higher protein content.



In many states, the use of extra nitrogen, along with other research-approved practices, is expanding corn production, increasing farm income and providing you with a more abundant supply of many things you eat, wear and use. Here again, Barrett contributes to American progress. Nitrogen, the element that makes corn grow, is a Barrett basic product.

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THE EDITOR COMMENTS

AN interesting trend toward the use of higher analysis fertilizer is noted in the annual U. S. Department of Agriculture report on fertilizer consumption in the U. S. for the fertilizer year ending June 30, 1949. The fact that consumption exceeded that for the previous year by some 723,484 tons, or 4.1 percent presents an encouraging picture, but the details are even more significant.

Sales of higher analysis grades are increasing. The 3-12-12 grade made up 5 percent of the total tonnage last year, with 597,622 tons being used. This year it represents 7.7 percent of the total, with a consumption of 859,699 tons. The 4-7-5 analysis, on the other hand, dropped in popularity from 1 percent of the total tonnage to .9 . . . the respective tonnages being 118,553 for last year, and a slight drop to 111,134 tons this year. A considerable jump was made in the 0-20-10 mixture, it having increased from 75,709 to 94,776 tons in the year. A new analysis, at least one which did not appear in last year's tabulations, is 0-20-20, which was consumed to the amount of 67,935 tons, making up .5 percent of the total.

Of course the figures speak for themselves, but the reader may have to do some gleaning to find trends which may not appear on the surface. However, whatever the figures say, and regardless of how they may be interpreted, it is certainly evident that the fertilizer industry is continuing to do a superb job of furnishing plant food for American agriculture. The production of nearly 20 million tons of mixed fertilizer materials each year is no small accomplishment. Higher analysis grades are being recommended and sold, which seems to us to be the logical but gradual method of accomplishing this end.

The latest tabulation reports the largest tonnage of fertilizer ever consumed in a year's time. How far this continual increase will go is anyone's guess; but the industry generally reports a decline in sales since mid-1949. This may be due

in part to current uncertainty about Government supports and the falling prices of some farm crops. But fertilizer sales are still at a high level, compared to pre-war figures, even though down somewhat from their peak.

PREDICTIONS of heavily increased losses to agricultural crops due to insect damage this crop year have been made by U. S. Department of Agriculture entomologists and economists. The reasons lie in the mild winter which permitted the survival of far more insect pests than ordinarily emerge after the cold months.

Estimates are that the anticipated losses this crop year may reach twice the 1949 figure. This estimate is based on reports made by entomologists from all parts of the nation. The menace threatens not one or two crops only; it is casting a shadow over a wide variety including corn, cotton, many fruits and vegetables and cereals. The grasshopper infestation, for example, looms unusually large.

In 1945, grasshopper losses totaled some 12½ million in corn alone. In 1946, the loss was \$22,743,000; last year, over 27 million. The corn borer is an even more dangerous crop foe. Losses from borer attacks increased from nearly 37 million in 1945, to 350 million last year!

Insecticide manufacturers, their suppliers, wholesalers, distributors and the whole trade, are fully aware of the situation. They are making an honest effort to avoid mistakes of the past, and hope to have sufficient amounts of the correct material on hand at the proper place at the right time to take care of the inevitable demand. But accomplishment requires more than effort by the trade alone. The buyer . . . the ultimate user, must anticipate his needs early, as has been argued here many times . . . else the distribution of insecticides will break down at that level.

(Editorial Continued on Page 83)

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One Hundred Years of Fertilizer Progress

by

Colin W. Whittaker

U.S.D.A., Beltsville, Md.
Member of Agricultural Chemicals
Editorial Advisory Board

Guest Editorial written especially for
this issue of Agricultural Chemicals.



FROM its humble beginning some 100 years ago in Baltimore, the chemical fertilizer industry has now grown to a place of great importance in the national economy. Today the industry employs more than 30,000 persons, operates at least 700 plants, and produces annually products valued at more than half a billion dollars. But such progress was not made overnight. Expansion of the industry was slow during the early years; demand for chemical fertilizers was practically nonexistent, and, in fact, there was much prejudice against their use. Strangely enough, some of this prejudice has endured to the present day. The industry of the early days suffered from many handicaps, including want of essential data on the chemical and agronomic factors involved, as well as a lack of real understanding of the needs of agriculture and of plant nutrition. Primary materials were also inferior to those available later.

Over the years, the scene has changed gradually. Superphosphate appeared on the market

about 1850, followed a few years later by potash imported from Germany, a vast improvement over wood ashes. The Shanks process (later superseded by the Guggenheim process) revolutionized the production of nitrate of soda, and the byproduct coke-oven yielding ammonia and ammonium sulfate was introduced. Later still, following World War I, the American domestic potash and synthetic ammonia industries were developed, making the U. S. virtually independent of foreign supplies of nitrogen and potash. These developments, and others too numerous to mention, have given the industry better and more concentrated materials with which to work. Formerly it was difficult to compound a mixed fertilizer containing more than about 15 percent of total plant food. The improved materials now available, such as nitrogen solutions, muriate of potash, concentrated superphosphate, and others, make possible mixtures containing more than 40% of plant food.

The great progress that the industry has made, and for which

(Turn to Page 87)

*A report on results of investigations
in Northern California during 1949, for*

Tomato Insect Control

A. E. Michelbacher, W. W. Middlekauff and Charles Hanson

University of California, Berkeley

EXTENSIVE investigations on the use of a number of chlorinated hydrocarbons for the control of caterpillars on tomato have been in progress since 1946. Data were obtained in that year and also for 1947 and 1948 by Michelbacher et al. These investigations covering a three year period, showed that DDT and DDD could be used safely on canning tomatoes, and resulted in excellent control without creating an objectionable residue problem when properly applied. Of the other chlorinated hydrocarbons tested, toxaphene showed the most promise, but unlike DDD or DDT, it has not received any great amount of commercial testing. Because DDD is more effective than DDT against the tomato hornworm, *Protoparce sexta* (Johan.) the former is the insecticide most widely used. This is particularly true in those areas where hornworms are likely to be a problem. Although very little DDD or DDT was used commercially for the control of

tomato insects in 1946, since then their use has been widely expanded.

In 1948 most of the acreage was treated with one or the other of these insecticides, and treatments for the control of caterpillars in 1949 were restricted almost entirely to these two materials. Along with the general use of the new insecticides, the importance of proper timing of applications has been stressed, with a resultant decline of insect damaged tomatoes delivered to the canneries. This trend is illustrated in table 1. The information shown emanates from the Bureau of Fruit and Vegetable Standardization, California State Department of Agriculture and was taken from bulletin number 3995 issued by the Canners League of California. The table shows that the amount of infested fruit in delivered loads has fallen to almost nothing.

There is but little question that a large proportion of this reduction has been due to the use of DDT and DDD in the tomato insect con-

trol program. The decline in 1949 occurred despite the fact that all information available indicated that the season was more favorable than usual for a number of caterpillars that are important pests of tomato. This was particularly true in regard to the yellow-striped armyworm, *Prodenia praeifica* Grote, which was present in outbreak proportions on other crops. In previous years, outbreaks of these proportions would have resulted in serious loss to the tomato crop.

During the 1948 season the population of several pests generally not considered important to tomato increased to a level where they caused some concern. Among these were the leafminer, *Agromyza subpusilla* Frost, the salt marsh caterpillar, *Estigmene acraea* (Drury), and an unidentified red spider mite. Of the above, the leafminer was the only one that was widely distributed. Late in the season it was abundant in most fields and caused considerable defoliation, but was not destructive except in several fields near Stockton where defoliation occurred early in the summer. In these fields there was a serious loss of fruit due to sunburn.

The question that arose in regard to these unexpected pest problems was whether or not the widespread use of DDT and DDD could in any way have been associated with them. With this in mind the 1949 investigations were designed so that the seasonal population trends of these

TABLE 1
Averages of Percentage of Caterpillar Infested Tomatoes In
Acceptable and Rejected Loads of Tomatoes Received During
1946 to 1949, Inclusive, In California

Quality of load	Per cent infested fruit			
	1947	1947	1948	1949
Accepted	0.50	0.49	0.07	0.04
Rejected	1.40	1.03	0.24	0.07

possible pests could be studied in relation to several tomato insect control programs.

1949 Investigations

EXPERIMENTS were conducted at Patterson, Stanislaus County, and at Woodland, Yolo County. In addition, general observations on insect conditions were made throughout the principal tomato-growing regions in northern California. With the exception of the untreated checks, the plots in the experimental series were approximately 10 acres in extent. In both localities the treatments were applied with 5 row power dusters, and in all cases the coverage obtained was exceptionally good.

The treatments investigated were as follows:

1. Check—no insecticide
2. 10% Toxaphene, 40% sulfur
3. 5% Toxaphene, 3% DDT, 50% sulfur
4. 5% DDT, 50% sulfur
5. 5% DDD, 50% sulfur

The rate and time of application and the control obtained of all species of caterpillars infesting tomatoes in the Woodland experiment are given in table 2, and for the Patterson experiment in table 3.

An examination of the tables shows that all the treatments resulted in satisfactory control. It is believed that the infestation in the checks does not fairly represent the conditions that would have prevailed had the

entire field been left untreated. The checks were small and experience gained during the past several seasons has indicated that small untreated checks in fields treated with the new effective insecticides reflect an infestation much smaller than would normally be expected. This is further substantiated by the fact that the known abundance of some important caterpillars attacking tomatoes occurred on other crops in sufficient abundance to indicate a greater infestation on tomatoes.

Of the above mentioned seldom destructive pests of tomato, the only one encountered in the experi-

(Turn to Page 95)

TABLE 2
Treatment and Per Cent of Infested Tomatoes In Experimental Blocks at Woodland

Treatment	Approximate pounds per acre and date of application			Per cent infested tomatoes					
				September 12			September 20		
	First	Second	Third	Severe	Superficial	Total	Severe	Superficial	Total
Check*	—	—	—	13.37	2.87	16.24	9.99	1.50	11.49
10% Toxaphene, 40% sulfur	19.1	30.0	26.0	0.66	0.22	0.88	0.00	0.00	0.00
5% Toxaphene, 4% DDT, 50% sulfur	26.2	27.5	27.0	0.11	0.55	0.66	0.00	0.00	0.00
5% DDT, 50% sulfur**	26.2	32.5	29.0	0.33	0.66	0.99	0.00	0.00	0.00
5% DDD, 50% sulfur**	23.0	29.0	34.0	0.11	0.55	0.66	1.25	0.75	2.00

* Dusted with sulfur July 18.

** Sulfur omitted in the third application.

TABLE 3
Treatment and Per Cent of Infested Tomatoes In Experimental Blocks at Patterson

Treatment	Approximate pounds per acre and date of application			Per cent infested tomatoes								
				September 6			September 16					
	First	Second	Third	Severe	Superficial	Total	Severe	Superficial	Total			
Check*	—	—	—	12.00	0.75	12.75	7.75	2.50	11.25	3.25	3.75	7.00
10% Toxaphene, 40% sulfur	25	30	35	1.22	0.10	1.32	0.83	0.16	0.99	0.75	0.25	1.00
5% Toxaphene, 3% DDT, 50% sulfur	20	30	30	0.55	0.00	0.55	0.00	0.00	0.00	0.00	0.50	0.50
5% DDD, 50% sulfur**	35	30	30	0.22	0.00	0.22	0.33	0.00	0.33	0.00	0.25	0.25

* Dusted with sulfur July 20.

** Sulfur omitted in the third application.

Consumption of Commercial FERTILIZERS in the United States, 1948-1949

by

Walter Scholl & H. M. Wallace

Division of Fertilizer and Agricultural Lime
Bureau of Plant Industry, Soils and Agricultural Engineering
Agricultural Research Administration
U. S. Department of Agriculture
Beltsville, Maryland

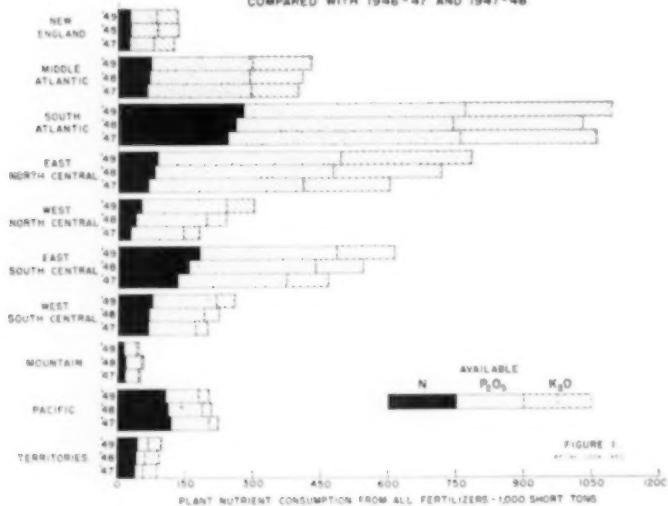
CONSUMPTION of commercial fertilizers in the United States has reached a new high level. A total of 18,541,885 short tons was sold for domestic consumption during the year ended June 30, 1949. Compared with the revised total of 17,818,401 tons sold in 1947-48¹, this represents an increase

of 4.1 percent. Included in the total is 1,420,951 tons distributed under Purchase Order and Contract Plans of the U. S. Department of Agriculture, 25,953 tons for farm test demonstrations and 283,545 tons sold to farmer cooperatives by the Tennessee Valley Authority. The amount of plant nutrients supplied by all com-

mercial fertilizers for domestic consumption was 3,934,728 tons, an increase of 8.4 percent.

The data herewith, Tables 1 through 4, show the number of tons of fertilizer reported shipped by manufacturers throughout the forty-eight states and the territories. The amount of plant nutrients supplied by commercial fertilizers shown in Table 5 and Figure 1, was computed from the tonnages determined in this survey and from analyses reported in state official analyses bulletins. The weighted average plant nutrient content of commercial mixtures is shown in Table 6. For this 10th annual survey, fertilizer manufacturers, state fertilizer control officials and agronomists cooperated freely in providing information.

FIGURE 1
PLANT NUTRIENT CONSUMPTION
BY REGIONS IN 1948-49
COMPARED WITH 1946-47 AND 1947-48



Total Consumption
THE trend in consumption² of fertilizers compared with 1947-48 is upward in most of the West Central States and downward in the

¹Acknowledgement is made for the assistance of A. L. Meiering, K. D. Jacobs and G. A. Bennett.

²Walter Scholl and Hilda M. Wallace, Agricultural Chemicals, Vol. 4, No. 6, 34-39, 81-82 (1949).

³The words "consumption," "sales," and "shipments" are used in this report as though they were synonymous. The data represent shipments by manufacturers to dealers and farmers, and no doubt differ slightly from actual consumption in agriculture during the period.

TABLE 1

Consumption of Commercial Fertilizer Mixtures and Separate Materials
During the Year Ended June 30, 1948¹

Unit: 2,000-pound Tons

State & Region	Commercial Mixtures			Separate Materials			All Fertilizers 1947-48 Year Total	Consumption Compared with 1947-48	
	July 1 - Dec. 31, 1946	Jan. 1 - June 30, 1948	1948-49 Year Total	July 1 - Dec. 31, 1946	Jan. 1 - June 30, 1948	1948-49 Year Total		All Fertilizers 1947-48 Year Total	Total Plant Nutrients Percent
Maine	22,159	195,877	217,936	4,801	7,318	11,819	229,655	88	81
New Hampshire	2,107	15,560	18,887	2,585	7,794	10,370	26,046	80	85
Vermont	4,333	23,788	28,091	8,987	28,186	37,182	66,873	118	119
Massachusetts	6,733	61,992	70,728	4,585	16,977	30,980	91,680	107	114
Rhode Island	1,117	14,938	18,085	818	2,810	5,428	19,325	102	104
Connecticut	4,367	30,588	34,923	5,805	27,727	34,190	69,113	107	109
New England	42,916	380,481	403,297	27,737	90,221	117,988	521,286	97	99
New York	67,568	363,829	431,197	45,104	112,915	156,019	567,215	101	101
New Jersey	81,331	197,101	249,432	8,968	18,396	27,383	109	112	
Pennsylvania	146,826	349,391	495,896	23,261	65,733	95,584	565,580	104	106
Delaware	16,147	36,099	64,248	886	2,118	2,800	57,046	105	106
District of Columbia	231	1,128	1,348	213	475	888	2,034	118	114
Maryland	79,006	143,944	221,949	8,686	17,726	24,433	246,582	101	101
West Virginia	10,104	40,368	56,580	9,693	36,833	45,228	101,776	102	102
Middle Atlantic	369,961	1,130,888	1,809,816	93,212	263,203	346,413	1,866,039	103	106
Virginia	142,750	417,613	560,585	82,198	116,877	146,875	709,238	108	108
North Carolina	217,077	1,205,708	1,422,780	116,815	276,143	393,476	1,815,286	110	113
South Carolina	111,461	800,706	981,183	44,108	121,461	275,487	1,046,780	110	108
Georgia	104,001	889,485	933,453	86,908	180,420	284,528	1,277,981	100	100
Florida	234,204	442,585	680,090	20,884	31,316	86,180	738,270	108	101
South Atlantic	809,583	3,567,296	4,375,849	358,409	824,217	1,189,826	5,356,476	108	108
Ohio	336,028	639,869	875,914	19,069	56,000	55,069	930,975	109	113
Indiana	257,675	469,861	737,838	61,120	89,226	99,346	828,982	103	108
Illinois	135,167	235,388	370,843	351,771	280,311	602,082	972,825	98	111
Michigan	144,863	280,004	404,567	12,789	45,583	61,372	465,939	113	116
Wisconsin	96,646	250,635	357,284	18,808	23,374	40,982	398,296	94	98
West North Central	972,066	1,763,778	2,735,844	445,347	415,494	866,841	3,594,882	105	110
Minnesota	45,234	105,210	148,444	26,010	45,155	105,185	251,597	111	113
Iowa	65,700	171,064	227,732	49,974	80,450	130,432	366,144	119	126
Missouri	123,845	184,178	280,041	45,236	65,480	106,716	388,787	120	123
North Dakota	8,309	10,802	12,991	3,928	4,803	8,829	21,520	94	99
South Dakota	1,738	2,947	4,605	1,442	3,489	4,931	9,616	89	90
Nebraska	3,733	6,385	10,088	8,976	18,900	27,876	37,683	160	187
Wyoming	32,358	10,561	47,889	34,123	31,211	65,344	113,233	118	118
West North Central	279,006	462,866	741,870	181,424	287,286	446,880	1,180,850	116	126
Kentucky	75,614	285,405	361,017	54,912	136,223	190,185	551,152	116	121
Tennessee	94,705	258,800	353,866	42,191	103,378	145,483	499,048	100	101
Alabama	130,732	714,864	846,598	143,113	197,323	340,454	1,186,050	108	113
Mississippi	81,210	280,881	370,091	140,149	189,344	335,493	705,584	100	116
West South Central	362,341	1,547,546	1,930,289	386,385	626,162	1,011,525	2,941,814	108	113
Arkansas	28,702	132,988	181,887	88,862	96,396	158,287	316,914	137	139
Louisiana	39,355	121,795	181,180	42,017	58,828	98,658	246,836	96	99
Oklahoma	11,535	36,146	47,484	28,361	28,368	54,309	101,903	128	135
Texas	34,668	107,474	232,142	144,271	108,511	247,582	479,724	106	107
West South Central	104,291	466,372	582,663	276,071	280,732	555,805	1,146,466	111	116
Montana	406	2,476	2,882	2,106	4,296	6,402	9,284	74	76
Idaho	2,424	9,064	11,488	12,178	21,115	34,291	45,776	78	69
Wyoming	68	928	998	1,090	8,011	4,101	5,087	62	91
Colorado	3,234	14,070	17,304	6,380	12,977	18,476	55,779	109	116
New Mexico	579	888	1,188	4,847	8,346	12,982	14,148	133	161
Arizona	7,362	9,856	17,226	50,291	18,810	44,710	61,930	79	92
Utah	269	1,747	2,011	2,149	8,949	8,986	11,000	63	66
Nevada	87	128	185	290	288	242	727	73	86
Mountain	14,428	38,832	53,260	69,147	71,364	130,801	185,761	83	89
Washington	7,850	20,289	28,009	17,815	34,819	52,354	80,543	97	99
Oregon	5,358	16,307	21,885	28,713	22,885	52,568	71,283	87	108
California	97,513	97,580	196,103	420,143	457,006	877,143	1,072,246	89	97
Pacific	110,521	134,268	244,777	461,369	521,706	983,078	1,227,552	90	98
Hawaii	18,665	18,384	36,949	34,967	32,812	69,489	106,418	107	109
Puerto Rico	113,174	100,828	214,000	7,257	15,261	20,488	254,590	94	98
Territories ^{2/}	131,739	110,308	281,041	44,194	45,783	89,987	340,998	98	100
Continental U. S.	3,064,982	9,103,485	12,588,465	2,265,079	3,349,343	8,612,922	18,200,887	104	109
1946-48 Total	3,216,721	9,622,785	12,639,806	2,307,273	3,398,106	8,702,379	18,641,883 ^{3/}	104	106
1947-48 Revised Total ^{4/}	3,161,513	9,046,976	12,210,489	2,584,806	3,002,816	8,807,321	17,818,401		

¹ Includes: ground phosphate rock, basic slag, minor element materials, such as borax, sulfur, manganese sulfate, etc. used as separate materials, also fertilizers distributed by Government agencies. Does not include liming materials, but includes gypsum.

² Total includes 90 tons mixed goods shipped to Alaska.

³ Includes 509,565 tons of materials not containing N, P₂O₅ or K₂O.

⁴ Deduct from California, Spring 1947-48, Separate Materials, 37,538 tons in the 1947-48 report.

⁵ Total plant nutrients: N, available P₂O₅ and K₂O.

Mountain and Pacific States. The highest tonnage increase is in North and South Carolina. The combined consumption in these two states is 267,994 tons more than in 1947-48. California showed the largest decrease in use amounting to 92,933 tons less than that consumed in the year before. Distribution in 1948-49 and 1947-48 was 42.7 and 42.5 percent of the total in the Atlantic Coast States, 47.9 and 46.8 percent in the Central States, 7.6 and 8.7 percent in the Mountain and Pacific States, and 1.8 and 2.0 percent in the Territories, respectively. Consumption in the January-June, 1949 period amounted to 13,017,891 tons or 70.2 percent of the total compared with 67.8 percent for the corresponding period in 1947-48.

Mixed Fertilizers

MIXED fertilizers amounted to 12,839,506 tons and represented 69.2 percent of the total consumption of all fertilizers, compared with 68.5 percent for 1947-48. The total number of grades sold in the Continental United States that were specified by guaranteed analysis was 894, including 458 grades selling below 100 tons each. In addition there were probably 100 or more grades sold as special mixtures whose guaranteed analyses were not reported. The leading grade 2-12-6 dropped in sales from 1,702,266 tons to 1,315,872 tons. Sales of 3-12-12 showed the largest increase of any grade; consumption rose from 397,622 tons to 971,954 tons. Seven grades supplied 50.7 percent of the total tonnage of commercial mixtures consumed in the Continental United States. The 41 principal grades supplying more than 90 percent of the total consumption of mixed grades are shown in Table 2.

The principal grades sold in each region were practically the same as in 1947-48. In all regions, however, a change was made among the top 10 grades shown in Table 3, by one of three grades. Although the difference in the total tonnages of the grades involved in replacing those of the previous year was 6,570 tons less, the additional plant nutrients supplied by

the exchange of grades amounted to 29,972 tons more. The new grades supplied 4,363 tons less of nitrogen, 8,225 tons more of phosphates and 26,110 tons more of potash. The weighted average composition of the new grades is 2.94-13.58-11.70 compared with 3.92-11.44-5.40 for the replaced grades.

Materials

CONSUMPTION of fertilizer materials used for direct application to the soil or for home mixing amounted to 5.7 million tons compared with 5.6 million in 1947-48.

TABLE 2

Principal Grades Consumed in the Continental United States During Year Ended June 30, 1949

grades	Consumption	Proportion of Total	
		tons	percent
2-12-6	1,315,872	10.4	
3-12-0	397,622	7.0	
2-12-12	971,954	7.7	
3-12-6	109,459	1.9	
2-12-9	626,281	5.4	
4-12-6	90,900	0.6	
4-12-9	120,622	4.9	
4-12-12	104,964	4.4	
4-12-15 ^{1/2}	61,746	2.6	
4-12-9	616,859	5.3	
4-12-12	617,710	5.3	
6-0-6	946,520	8.8	
6-0-6	203,539	2.2	
6-0-6	211,416	2.1	
6-0-9	211,518	1.8	
6-0-9	217,638	1.7	
2-12-12-12	110,418	1.3	
3-12-6	140,700	1.2	
3-12-6-9	141,512	1.2	
3-12-6-12	119,050	1.0	
6-0-6	116,711	1.0	
4-0-7	111,156	1.0	
4-12-10	90,170	1.0	
4-12-10	96,900	1.0	
4-12-10	76,714	0.6	
4-0-8	75,462	0.6	
6-0-6-9	70,113	0.6	
6-0-6-12	74,250	0.6	
6-0-6-12	71,472	0.6	
6-0-6-12	67,980	0.6	
7-0-7	55,765	0.6	
6-0-10-12	52,378	0.6	
4-0-6-12	46,617	0.4	
4-12-9	61,260	0.5	
4-0-6-12	37,240	0.3	
4-0-6-12	29,270	0.3	
6-12-15	23,137	0.2	
6-24-12	20,300	0.2	
6-0-6-7	20,761	0.2	
2-10-8	39,190	0.3	
All grades	11,360,109	30.2	
All other grades	1,071,275	6.8	
Commercial mixtures ^{2/}	11,431,384	1.2	
	11,880,465	100.0	

^{1/} Grade 2-12-12-12 reported, which should be deleted and added to grade 2-12-12, which totals a total of 249,070 tons for these grades.

^{2/} Commercial mixtures not reported.

The use of potash materials increased approximately 37 percent, natural organics 28 percent, and chemical nitrogen materials 14 percent, whereas phosphates decreased 3 percent and

minor and secondary element materials 19 percent. The increases were largely due to greater use of muriate of potash, dried manures, sodium nitrate and ammonium nitrate-limestone mixtures. The use of anhydrous ammonia for direct application to the soil increased from 43,373 to 65,596 tons. The decrease in consumption of normal superphosphates was partially offset by an increased use of concentrated superphosphates and 16-20 ammonium phosphate. The drop in secondary element materials was due to a lower consumption of gypsum.

Plant Nutrients

COMMERCIAL mixtures supplied 2,896,178 tons of plant nutrients (N, available P₂O₅, K₂O) and materials used as such 1,038,550 tons a total of 3,934,728 tons. In addition 347,922 tons of "insoluble" phosphoric oxide was supplied by all phosphate materials used in mixtures and those consumed for direct application. The increased consumption of available plant nutrients was 303,645 tons (8.4%) compared with 1947-48. Consumption of nitrogen increased 63,227 tons (7.4%), available phosphoric oxide 88,070 tons (4.8%) and potash 152,348 tons (16.5%). The increase in "insoluble" phosphoric oxide was 99,739 tons (4.6%).

Approximately 74 percent of the total plant nutrients was in the form of commercial mixtures. The weighted average plant nutrient content of mixtures was generally higher in all states as shown in Table 6. The plant nutrient content of mixed fertilizers averaged 22.35 percent compared with 21.90 percent for 1947-48. In a number of states in the West North Central, Mountain regions and Maine, the use of mixtures having as high as 35 percent of plant nutrients is now common. Based on the average plant nutrient content of mixtures for the United States, nitrogen decreased 0.05 percent, whereas phosphoric oxide and potash increased 0.07 and 0.63 percent, respectively.

(Tables 3, 4, 5 and 6 follow on succeeding pages.)

AGRICULTURAL CHEMICALS

TABLE 3

Principal Fertilizer Grades Consumed in the Regions of the United States
During Year Ended June 30, 1949

Units: 8,000-pound ton

New England													
State	Grades ¹	8-10-10	8-9-12	8-8-7	0-14-14	8-12-16	8-15-16	8-5-5	8-7-10	7-7-7	8-0-15	All Other Grades	Total
Maine	45	33,833	71,186	6,718	3,809	26,737	18,795	0	18,617	785	10,091	31,300	217,636
New Hampshire	27	8,114	0	1,086	3,833	184	1,308	12	0	1,080	0	2,872	19,667
Vermont	31	8,529	0	1,080	9,775	0	8,777	21	0	1,309	0	4,525	29,121
Massachusetts	36	15,145	0	15,481	6,339	0	2,129	9,256	0	7,631	0	18,727	70,726
Rhode Island	26	8,769	0	1,086	1,083	0	189	0	0	1,086	0	8,910	18,086
Connecticut	47	9,822	0	10,556	276	1,291	14,616	0	0	8,904	0	15,052	84,923
New England	77	80,238	71,186	36,404	25,855	26,186	24,447	25,806	18,617	18,794	10,091	72,113	405,297
Middle Atlantic													
State	Grades ¹	3-12-6	5-10-10	5-10-5	4-12-6	4-12-12	4-12-6	0-14-7	5-9-12	6-12-6	7-7-7	All Other Grades	Total
New York	57	44,542	84,954	164,844	8,302	30,037	21,105	874	1,369	22,571	3,890	48,239	481,107
New Jersey	82	16,458	114,226	31,181	31,954	1,818	4,828	1,480	18,724	180	0	21,242	269,452
Pennsylvania	65	270,126	65,704	28,465	31,720	10,1	19,800	13,465	2,622	2,324	62,815	1,208,806	
Delaware	57	18,296	0	8,944	3,916	8,047	3,903	854	3,773	0	78	13,279	84,245
District of Columbia	21	110	0	858	8	186	9	0	0	0	0	388	1,346
Maryland	46	130,027	4,785	16,182	11,860	24,450	2,779	8,273	8,940	0	2,324	35,589	221,949
West Virginia	19	19,313	7,920	2,687	8,800	0	11,480	7,686	0	0	0	2,074	86,580
Middle Atlantic	114	479,192	381,815	244,561	84,288	70,354	50,924	33,465	27,560	25,806	17,961	184,625	1,500,818
South Atlantic													
State	Grades ¹	4-10-6	2-9-6	4-0-6	3-12-6	5-9-6	20-20	6-0-6	4-0-8	4-7-6	2-12-12	All Other Grades	Total
Virginia	36	17,100	80,307	0	168,900	4,181	53,802	31,850	25	0	80,717	165,446	580,365
North Carolina	37	434,519	405,017	0	116,839	61,783	66,924	70,178	113	0	88,012	234,932	1,427,780
South Carolina	29	347,531	75,177	304	31,457	108,956	80,942	13,482	41,167	0	28,117	720,165	
Georgia	75	12,875	89,445	561,999	4,688	47,195	25,026	59,476	35,443	0	827	186,698	995,455
Florida	829	338	301	80,256	85	2,714	3,914	3,952	54,244	111,154	80	483,842	680,080
South Atlantic	562	902,307	626,045	612,859	340,748	221,247	230,610	178,728	130,990	111,154	107,617	1,025,034	4,576,849
East North Central													
State	Grades ¹	2-12-6	5-12-12	0-12-12	3-12-9	4-12-8	0-20-10	5-9-18	2-12-17	0-20-20	2-16-6	All Other Grades	Total
Ohio	55	450,765	185,056	18,456	45,785	24,277	7,868	2,095	8,981	5,859	0	157,067	575,914
Indiana	38	349,084	287,949	49,861	34,022	1,366	18,206	22,286	11,718	68	89,626	727,536	
Illinois	36	47,782	190,306	28,712	6,786	18,348	10,255	18,802	5,175	1,930	30	49,719	370,643
Michigan	31	184,437	71,967	14,433	13,078	15,780	5,386	18,882	10,126	9,584	34,808	33,536	404,587
Wisconsin	46	29,216	166,061	16,790	15,940	15,271	61,529	14,051	27	15,699	0	46,599	357,284
East North Central	90	961,264	855,560	127,222	121,481	82,656	76,396	64,797	44,775	42,860	34,886	326,347	2,750,844
West North Central													
State	Grades ¹	2-12-6	4-12-6	5-12-12	4-12-0	4-12-12	4-12-6	4-12-6	5-9-18	3-18-8	0-20-10	All Other Grades	Total
Minnesota	88	8,476	4,821	28,982	1,259	28,218	5,682	7,682	1,216	6,077	13,063	45,901	140,444
Iowa	24	27,441	5,978	90,541	98,768	28,578	25,839	16,682	2,747	10,922	1,945	29,785	237,732
Missouri	29	84,978	104,773	16,140	2,730	2,621	0	3,181	19,011	1,003	1,898	44,318	580,041
North Dakota	30	84,772	280	3,380	234	1,704	247	217	2	2,145	1,097	2,943	12,991
South Dakota	22	37	413	45	3,684	80	0	0	0	0	0	468	4,655
Nebraska	23	9	93	27	4,900	0	0	0	0	0	0	4,936	10,088
Kansas	33	10,047	10,946	401	10,402	0	0	0	0	0	0	6,110	47,989
West North Central	97	181,472	127,402	107,974	80,762	35,068	30,079	26,817	22,976	22,407	17,866	182,347	741,970
East South Central													
State	Grades ¹	4-8-4	4-10-7	5-10-5	3-9-6	2-12-6	4-12-4	6-0-6	5-9-5	4-8-8	4-12-8	All Other Grades	Total
Kentucky	32	21	0	8,077	71,589	111,492	20,059	72,979	2	126	46,285	30,406	361,017
Tennessee	33	16,580	129	10,912	129,058	41,031	61,099	6,827	1,060	80	80,697	333,585	
Alabama	32	533,499	371,468	2,092	0	0	0	3	32,444	48	0	108,744	946,596
Mississippi	15	60,494	21,535	254,984	0	0	40	0	45,610	7,901	0	1,619	170,061
East South Central	94	410,903	393,150	296,066	200,625	155,125	81,148	79,909	77,522	73,381	46,315	186,386	1,930,229
West South Central													
State	Grades ¹	5-10-5	4-12-4	6-8-12	3-9-6	6-8-6	6-8-5	6-10-6	0-14-7	4-8-8	4-12-8	All Other Grades	Total
Arkansas	30	52,010	27,681	37,101	31,827	1,950	2,195	1,076	1,012	5,760	12	3,053	161,657
Louisiana	22	58,439	43,459	1,498	0	18,399	9,808	7,906	4,006	1,031	8,246	6,997	151,180
Oklahoma	24	17,791	28,108	30	172	23	70	180	618	38	1	3,187	47,684
Texas	18	117,883	86,405	0	0	5,727	0	2,958	6,411	6,042	15	9,786	131,145
West South Central	43	241,073	183,158	28,629	81,999	21,099	11,074	11,695	11,045	10,871	8,274	22,966	892,685
Mountain													
State	Grades ¹	10-10-0	10-20-0	8-20-0	10-16-8	10-18-0	10-16-8	6-24-6	5-10-5	7-21-7	All Other Grades	Total	
Montana	15	0	1,857	314	0	450	570	0	0	0	0	101	2,980
Idaho	35	3,454	1,799	880	708	1,708	1,802	81	0	90	0	1,218	11,488
Wyoming	18	5	9	0	0	0	0	350	0	0	0	543	996
Colorado	37	0	1,168	2,523	2,443	213	0	640	1,515	682	1,137	7,169	17,504
New Mexico	15	5	24	0	0	4	0	0	0	490	0	643	1,185
Arizona	47	7,085	5,543	0	0	991	0	0	0	0	0	3,912	17,729
Utah	23	97	399	293	2	135	216	59	0	0	0	843	2,011
Nevada	6	7	59	0	0	54	0	0	0	0	0	86	186
Mountain	103	10,659	10,124	3,968	3,181	3,073	2,267	1,700	1,315	1,262	1,137	14,904	53,260
Pacific													
State	Grades ¹	10-10-5	17-7-0	9-8-6	5-10-4	8-10-12	5-10-10	6-9-6	15-8-4	4-12-4	3-10-10	All Other Grades	Total
Washington	65	1,171	217	0	2,620	0	6,465	0	50	2,400	2,994	12,194	26,009
Oregon	67	416	0	0	1,489	0	2,982	0	0	1,866	2,186	12,432	31,668
California	210	40,163	32,246	21,874	15,394	10,876	22	10,188	6,262	2,524	2	50,062	195,103
Pacific	270	41,749	32,465	21,874	16,703	10,876	10,467	10,186	6,318	5,109	4,602	84,566	244,777

¹/ The number of grades in each state and region is exclusive of the number of special mixtures or miscellaneous grades, not specified by guaranteed analyses. Their tonnage is included in the totals.

TABLE 4

Principal Fertilizer Materials Consumed as Such, by States and Regions, During Year Ended June 30, 1947

Units: 2,000-pound Ton

State & Region	Amonium Bisulfate	Amonium Sulfate	Calcium Oxynitrate	Sodium Nitrogen Material ¹	Dried Manure ²	Other Organic ³	Phosphate Rock ⁴	Superphosphate 15-20%	Superphosphate 20-25%	Other Phosphates ⁵	Muriate of Potash 80 & 60%	Other Fertilizer Salts ⁶	Minor and Secondary Elements ⁷	Total	
Maine	250	210	494	704	42	811	0	0,884	1	140	111	37	247	11,118	
New Hampshire	20	15	27	254	8	186	20	1,109	0	73	246	26	23	10,379	
Vermont	9	0	23	230	30	173	30	10,869	0	324	459	0	18	37,188	
Massachusetts	135	50	155	8,991	74	1,850	4,967	270	0,664	0	614	10	11	20,980	
Rhode Island	26	120	19	260	6	225	674	1,763	0	110	116	4	13	9,428	
Connecticut	31	45	64	8,215	170	745	15,367	36	10,301	189	1,428	1,287	1,081	244	34,190
New England	462	427	759	6,658	337	3,042	21,381	425	75,260	189	2,968	2,813	2,076	628	117,986
Middle Atlantic	5,389	1,987	8,086	24,574	1,188	6,278	2,289	2,125	280,954	212	5,068	5,346	281	1,898	340,412
Virginia	8,992	137	1,088	53,961	12,064	601	290	2,347	9,326	3,501	801	308	9,401	166,019	
North Carolina	4,661	1,270	12,696	169,703	61,994	206	2,780	1,018	10,314	17	1,077	2,168	185	601	27,645
South Carolina	6,144	2,373	2,400	121,976	50,361	294	1,589	70,447	0	640	262	279	10,309	10,309	
Georgia	7,787	4,012	1,071	6,664	15,386	786	602	460	66,080	48	25	6	5	2,800	
Florida	614	675	1,068	17,350	1,288	1,480	2,011	1,770	1,287	0	160	2	0	608	
South Atlantic	25,456	8,903	18,720	459,461	107,284	3,387	12,078	3,510	310,046	16,377	61,064	24,218	30,880	86,085	1,159,626
Ohio	1,761	2,200	2,008	2,128	1,394	788	4,820	2,004	28,103	8,934	942	684	8	0	50,969
Indiana	7,644	301	1,114	505	1,907	1,018	2,079	46,079	29,751	3,628	216	1,048	215	13	99,348
Illinois	15,772	542	1,048	664	1,166	4,108	6,403	80,371	40,187	7,569	1,000	11,445	3,076	4	60,816
Michigan	4,000	2,103	404	1,271	207	975	7,140	1,068	41,910	1,000	220	174	100	41,379	41,379
Wisconsin	10,182	120	1,224	124	118	548	1,430	1,294	1,294	0	2,776	1,621	226	337	40,962
East North Central	38,532	6,304	8,306	6,538	4,803	6,769	25,108	577,565	16,214	16,360	8,901	15,905	3,589	401	88,941
Minnesota	4,367	70	15	0	28	769	2,383	3,077	28,400	2,005	205	150	150	50,139	50,139
Iowa	21,750	230	180	270	916	1,168	27,770	10,180	10,180	8,243	608	1,376	208	100,710	100,710
Missouri	13,769	341	650	263	2,000	648	1,770	44,182	28,000	14,480	302	1,024	1,376	0	108,549
North Dakota	781	26	0	0	0	0	0	280	2,552	4,116	360	17	1	0	4,829
South Dakota	312	240	0	0	0	0	2	288	540	2,952	680	0	0	4,931	4,931
Nebraska	14,316	213	70	0	584	101	270	727	6,158	2,810	450	4	0	78	27,370
Kansas	6,571	610	0	0	10	167	270	6,522	31,214	17,848	578	34	62	3	60,944
West North Central	69,682	1,720	826	245	1,188	1,752	6,284	20,470	192,860	70,080	7,079	2,922	2,922	2,702	440,680
Kentucky	6,682	626	1,887	4,818	788	207	430	27,947	12,975	9,304	2,601	704	4,100	31	190,130
Tennessee	6,300	610	1,388	16,946	1,365	608	916	1,206	74,108	11,300	56,144	950	4,860	397	140,483
Alabama	16,719	4,096	8,098	8,944	2,032	361	830	17	94,016	1,700	117,902	8,232	6,110	378	340,434
Mississippi	29,083	7,784	8,870	70,216	80,580	14	1,000	792	61,986	5,860	6,970	8,278	0	332,933	332,933
East South Central	91,086	17,048	15,500	180,010	36,218	1,238	3,576	29,920	150,162	20,922	220,298	11,791	20,190	712	1,011,828
Arkansas	23,501	5,115	6,096	18,556	4,079	18	66	681	64,177	2,053	16,282	6,801	9,397	2	188,857
Louisiana	14,144	1,740	1,180	19,942	0,262	90	65	10,121	25,149	880	14,930	1,337	41	99,888	99,888
Oklahoma	4,000	101	1,180	1,180	116	116	211	18,153	1,153	2,153	2,153	118	118	118	44,009
Texas	15,307	1,720	1,147	1,772	1,044	618	0	6,010	171,942	6,340	24,826	802	81	7,460	247,682
West South Central	81,654	6,091	8,379	57,001	14,811	633	1,473	20,045	268,801	7,470	64,405	12,228	11,341	7,640	558,803
Montana	0	568	0	19	0	0	110	0	151	6,857	0	3	0	930	4,463
Idaho	14,441	8,599	20	60	0	0	80	10,180	1,180	407	124	0	407	24,931	24,931
Wyoming	70	188	0	0	0	0	10	1,340	1,340	40	0	0	407	4,101	4,101
Colorado	1,601	3,112	18	230	80	63	750	0	5,394	7,466	580	386	97	1,745	18,476
New Mexico	271	705	0	70	500	0	469	0	1,269	4,294	3,298	80	0	150	12,982
Arizona	4,001	1,300	0	1,867	8,838	1,582	68	0	6,080	8,108	8,947	621	200	10,318	44,710
Utah	2,200	2,200	0	0	0	0	278	0	8,318	2,070	0	84	0	841	8,300
Nevada	0	9	0	0	0	0	31	0	210	281	4	0	0	4	442
Mountain	9,292	17,740	815	2,000	4,168	2,308	1,851	35,456	33,304	13,390	908	397	16,017	130,801	130,801
Washington	4,029	7,262	308	1,461	888	308	2,748	2,394	11,430	2,778	10,261	1,481	135	8,085	42,334
Oregon	5,869	8,023	471	988	80	4	621	60	14,098	4,818	10,089	1,197	190	8,207	58,508
California	21,501	54,821	7,240	1,289	10,880	2,970	3,602	70,088	15,388	49,112	2,749	2,167	27,588	877,185	877,185
Pacific	61,129	100,808	8,277	9,828	63,617	108,780	42,856	2,856	98,884	20,811	70,282	8,817	8,471	381,880	988,075
Continental U. S.	387,978	137,620	65,241	700,039	230,000	134,881	123,274	742,070	1,782,000	146,288	423,816	80,466	77,784	809,555	5,412,422
Territories	6,233	62,012	744	0	389	0	70	121	2,730	2	8,920	5,640	2,720	10	89,287
1947-48 Total	347,347	213,221	74,006	897,480	146,603	94,830	103,094	777,427	1,787,297	166,001	499,656	86,723	94,710	826,804	6,607,321

¹ Includes distribution by Government agencies and materials sold for home mixing. Excludes of liming materials but includes gypsum.

² Includes 1,120,000 acres 5,700; ammonium nitrate solution 6,974; ammonium nitrate - limestone mixtures 100,000; calcium nitrate 25,000; calcium carbonate - urea mixture 100,000; urea 17,000.

³ Includes farm manures.

⁴ Cited blend 1,120; compost 60; fish scrap and meal 2,671; hoof and horn meal 0; seed meal 1,000; castor pomace 0,810; cottonseed 15,041; linseed 1,001; peanut 6,000; soybean 340; tung 2,310; sewage, activated and other 88,601; twine animal 1,704; garbage 1,000; process 2,311; other 374. Excludes of cottonseed meal distributed through channels other than fertilizer manufacturers.

⁵ Includes calcium and other phosphates.

⁶ Includes ammonium nitrate (100,000), 100,000, (70-10) 100; ammonium sulphate 6,350; basic lime phosphate 1,000; basic zinc 200,000; bone meal, raw 6,000; steamed 9,400; calcium magnesium phosphate 2,000; calcium meta-phosphate 4,727; fused tri-calcium phosphate 17,222; phosphoric acid 3,350; precipitated bone 1,662; other 4,000.

⁷ Cotton ball salves 1,100; fish oil 2,543; murex salt 120,000; sodium sulfate 60,765; potassium sulfate 11,747; nitrate 960; carbonate 37; phosphate 300; sodium nitrate 214; magnesite sulfate 6,028; wood ashes 1,111; other 200.

⁸ Barite 2,101; magnesite gypsum 401,638; manganese oxide 200; metallic sulfate salter aluminum 10, copper 484, iron 56, magnesium 258, manganese 540, zinc 250; other 4,411; other 8,300. Excludes of minor and secondary elements sold through channels other than fertilizer manufacturers or the amounts added to commercial mixtures.

⁹ Deduct 27,500 tons ammonium sulfate from 1947-48 total for California in the report for that year.

TABLE 5

Consumption of Plant Nutrients, by States and Regions, Year Ended June 30, 1948^{1/}

Unit: 2,000-pound ton

State & Region	In Mixtures				In All Fertilizers					
	Nitrogen	Phosphoric Oxide	Potash	Total N. A.P.O ₅ & K ₂ O	Nitrogen	Phosphoric Oxide	Potash	Total N. A.P.O ₅ & K ₂ O		
	Available	Total			Available	Total				
Maine	12,993	22,285	24,139	27,586	62,514	15,290	24,058	25,933	77,453	64,781
New Hampshire	669	1,849	1,912	1,756	4,254	761	3,671	3,775	1,906	6,538
Vermont	1,008	3,742	3,865	3,905	8,580	1,070	11,249	11,683	5,890	16,209
Massachusetts	5,843	8,081	8,528	8,726	17,629	4,460	10,314	10,988	6,572	21,345
Rhode Island	802	1,641	1,762	1,618	3,968	932	2,040	2,212	1,591	4,563
Connecticut	3,018	4,485	4,869	4,562	12,063	4,584	7,290	7,797	5,866	17,740
New England	21,836	42,033	45,078	44,399	105,588	25,097	58,602	62,368	47,278	150,577
New York	20,748	47,983	50,727	35,491	102,234	23,975	75,251	79,114	34,015	135,241
New Jersey	11,854	26,892	28,651	22,678	61,424	15,724	29,329	31,159	24,030	67,085
Pennsylvania	18,507	61,564	64,711	37,596	117,767	19,539	77,946	82,132	37,902	135,387
Delaware	1,795	6,129	6,325	4,557	12,481	1,960	6,520	6,725	4,577	15,057
District of Columbia	74	137	144	81	292	105	183	203	89	387
Maryland	7,880	21,536	26,942	17,054	80,470	8,884	29,054	30,638	17,134	56,072
West Virginia	1,919	6,987	7,009	3,845	12,761	2,510	15,691	16,717	5,860	22,061
Middle Atlantic	62,777	175,250	186,109	119,402	557,409	70,597	233,954	246,565	121,607	426,268
Virginia	18,154	61,420	65,670	40,601	120,246	27,498	81,530	86,235	41,079	150,107
North Carolina	51,892	140,991	151,710	102,018	294,801	93,182	158,699	170,156	109,164	361,036
South Carolina	28,780	71,636	77,074	49,209	149,526	56,485	85,329	91,284	58,793	207,605
Georgia	40,108	85,180	92,711	63,112	188,400	62,902	107,487	116,769	69,812	239,701
Florida	30,445	51,326	64,645	45,714	127,486	34,262	54,597	65,590	48,570	137,429
South Atlantic	189,586	410,385	451,810	300,754	880,456	275,527	457,642	582,014	326,908	1,090,877
Ohio	21,726	110,392	117,419	74,082	204,200	24,798	117,879	125,988	74,565	216,940
Indiana	17,092	91,228	97,196	77,493	185,813	20,881	99,812	121,413	78,888	198,981
Illinois	10,242	46,768	48,807	42,479	98,469	16,592	72,289	224,090	50,177	140,058
Michigan	9,405	53,583	57,336	39,254	102,222	12,188	62,766	67,274	39,360	114,274
Wisconsin	8,123	46,096	49,011	44,492	99,710	12,208	60,376	66,030	45,584	108,158
East North Central	66,586	347,088	369,771	277,780	891,434	86,337	405,812	584,776	288,242	778,391
Minnesota	4,273	26,226	27,868	18,560	49,048	6,411	52,418	55,985	18,678	77,507
Iowa	6,260	33,987	36,104	17,394	59,641	16,671	53,340	63,677	16,120	86,151
Missouri	8,897	34,988	39,186	20,326	64,210	13,845	49,135	66,641	21,892	84,672
North Dakota	352	2,474	2,615	1,507	4,183	672	5,031	5,352	1,268	7,091
South Dakota	193	737	751	69	999	361	1,652	1,836	69	2,082
Nebraska	638	1,890	1,970	178	2,706	6,457	4,348	4,717	183	10,988
Kansas	1,897	6,283	6,564	2,165	10,346	4,281	20,799	24,064	2,206	27,286
West North Central	24,510	106,684	115,158	60,059	191,155	46,698	186,745	222,291	61,316	297,757
Kentucky	12,672	39,636	43,874	22,727	76,035	16,740	71,817	86,145	25,377	113,634
Tennessee	12,686	36,666	40,918	21,478	70,829	18,921	61,519	67,098	22,195	105,635
Alabama	39,751	77,422	87,276	51,160	168,335	61,618	110,696	121,916	65,402	227,616
Mississippi	20,456	36,052	40,388	21,687	78,197	80,729	56,284	63,452	26,666	164,679
East South Central	85,587	185,775	212,550	118,052	393,394	178,008	301,918	357,611	129,535	609,562
Arkansas	7,772	16,005	16,593	15,094	58,871	26,484	33,597	34,978	18,595	78,676
Louisiana	7,851	16,156	17,270	10,459	52,466	22,726	23,782	27,963	10,271	56,749
Oklahoma	2,017	5,527	5,877	2,128	9,872	5,321	12,699	18,841	2,212	18,232
Texas	10,561	25,542	27,258	10,979	47,082	21,040	70,482	76,427	11,176	102,690
West South Central	28,201	65,230	66,580	36,580	128,091	73,871	140,550	158,209	47,764	256,358
Montana	291	583	645	37	911	380	2,727	2,913	38	3,155
Idaho	1,177	1,631	1,781	209	3,017	2,501	8,017	8,285	285	10,803
Wyoming	93	222	235	18	343	179	1,539	1,587	28	1,546
Colorado	1,396	3,566	3,693	1,021	5,986	2,671	7,807	8,051	1,167	11,545
New Mexico	96	144	152	57	297	1,189	3,442	3,522	105	4,726
Arizona	1,630	2,500	2,808	176	4,506	6,369	8,069	8,317	656	16,113
Utah	188	526	540	43	587	778	1,047	2,012	68	2,683
Nevada	16	24	36	6	46	20	186	183	4	210
Mountain	5,087	8,998	9,486	1,877	15,682	14,007	33,444	34,778	3,340	49,791
Washington	1,718	3,058	3,359	2,316	7,092	6,578	9,168	10,348	3,264	19,010
Oregon	1,493	2,835	3,078	2,113	6,441	7,236	10,410	10,812	2,912	30,558
California	19,398	19,028	20,412	9,544	47,987	91,043	84,583	87,796	15,773	161,599
Pacific	22,656	24,921	26,859	13,573	61,500	104,857	74,161	76,958	21,549	250,967
Hawaii	4,170	2,947	3,184	6,078	18,196	16,418	7,122	7,475	10,785	34,326
Puerto Rico	21,667	13,510	14,236	19,733	84,910	26,935	13,741	14,478	19,748	59,412
Territories ^{3/}	25,843	16,489	17,434	25,519	88,151	42,547	20,875	21,983	30,541	95,763
Continental U. S.	486,631	1,368,200	1,482,598	973,216	2,828,047	877,599	1,920,534	2,267,668	1,042,532	3,840,985
1948-49 Total	512,474	1,384,689	1,500,030	999,056	2,896,178	919,946	1,941,709	2,289,631	1,073,073	3,934,728
1947-48 Revised Total	493,281	1,307,891	1,397,699	872,899	2,673,871	866,719	1,853,639	2,189,892	920,726	3,851,082

^{1/} Includes Government distribution.^{2/} Includes 3% of the phosphate rock as available P₂O₅, where used for direct application.^{3/} Includes 6 tons N, 12 tons P₂O₅, and 8 tons K₂O consumed in Alaska.^{4/} Deduct 7,064 tons Nitrogen in all fertilizer for California in 1947-48 report.

Source of
Information on Page 74

Petroleum Sprays

PETROLEUM has been used as a horticultural spraying material for over one hundred years. Dr. Donald E. H. Frear, in his standard text,¹ mentions the use of petroleum as insecticide by Goeze in 1787, and the pioneer crude oil spray projects of J. B. Smith in 1897 with 25% oil emulsions. And as is well-known, petroleum oils have been used many years for the control of scale and aphids on citrus and have been particularly effective as miticidal and ovicidal toxicants.

Following World War II and the emergence of the new concentrated low-volume spray materials, the petroleum oils came into use more prominently than ever. Where formerly petroleum was used "straight," or as an intrinsic insecticidal oil, the new organics cast petroleum in the new roles as (a) solvent for crystalline insecticidal materials such as

DDT, and (b) diluent, or carrier, of insecticidal mixtures.

The purpose of this paper is not to explore the intricate field of petroleum refining. An extensive amount of published material is already available, treating the technical phases of this field whose developments affect the every-day activities of persons in all walks of life. Merely to list the patents granted covering the chemical and physical activities of "chain bonds," "double bonds," and "cyclic rings" of the petroleum molecular structures, would require volumes.

There are, however, a few important facts concerning petroleum that should be understood by those engaged in outdoor spraying; those who have a working knowledge of plant physiology and elementary chemistry; and who seek more information about the newer concentrated

spray materials and their petroleum auxiliaries.

Differences In Oils

THE term "oil" is not applicable exclusively to the products derived from crude petroleum. Oils may be of animal, vegetable, or mineral origin. However, this paper is not concerned with non-mineral oils, but deals only with those used in outdoor spraying. These are originally taken from the ground or from under the sea as "crude petroleum."

What Is Petroleum?

ACCORDING to a strict literal translation of the word, "Petroleum" is made up of "rock" (*petra*); "oil" (*oleum*) and is the term used to describe all natural "hydrocarbons" in gaseous, liquid, or solid form with the exception of coal. Crude petroleum is made up almost entirely of these hydrocarbons, *i.e.*, compounds of hydrogen and carbon in the general ratio of 11-14% hydrogen and 83-87% carbon. In addition to the hydrocarbons, crude petroleum contains small amounts of combined other elements.

There are many accepted methods of classifying petroleum in the crude state dating from the classic 1855 analysis of Professor Benjamin Stillman of Yale University. Dr. Frear suggests a simple dual-division of the "series" or "classes of compounds" into *paraffins* and *naphthenes* for any consideration of petro-



Residual deposit on apple fruit and foliage from arsenate of lead with summer oil.

by
Edward A. Connell

Vice-Chairman,
Connecticut Tree Examining Board
Stamford, Conn.

leum for horticultural spray materials. A more detailed and comprehensive classification suggested by Kalichevsky and Stanger³ includes, in addition to the paraffinic and naphthenic hydrocarbons, the aromatic, olefinic, and asphaltic hydrocarbons, although it is debatable whether or not the olefinic classification as "hydrocarbon" is strictly correct if the original state of the crude petroleum is considered as the basis of analysis.

Crude petroleum may be constituted not only of solutions of these "series" of compounds but also of various combines of radicals from several different hydrocarbon series. Crude petroleum will vary considerably from one locality to another and, even among crude lots drawn from the same well on the same day,

The Refining Process

PRODUCTS of the refining process obtained at the early stages are the so-called "light distillates." The DDT solvent, "xylol" is, basically, petroleum xylene—a "light distillate," as is aviation gasoline. These two products are valuable because they have not been ultra-refined; because the aromatic hydrocarbons, or "unsaturated hydrocarbons," have not been removed. Without these unsaturated hydrocarbons present, xylol would not be a good solvent and aviation gasoline would lack its detonating qualities. At the other end of the refining processes are the "heavy distillates" such as sealing wax and beyond this is the final "sludge" stage

Park Spraying in Massachusetts community, with DDT in petroleum solvent applied by mist-sprayer.



from which are obtained some of the heavy industrial fuel oils, detergents, fertilizers, and other products.

"Unsulfonatable Residue"

A USER reads on the label of a drum of petroleum-base spray material, the legend "UR, 95%." This indicates that the sulfuric acid process has removed the aromatic hydrocarbon content of this oil to the extent that 95% of the oil cannot be further sulfonated; in other words, oil with "UR" of 95%, while not a good solvent, is practically "burn free" when sprayed on foliage, even in undiluted form. The higher the "UR" percentage rating, the safer the oil is for general spraying.

Of course, other factors in addition to aromatic hydrocarbon content can make the oil undesirable for certain types of spraying, such as an extremely high paraffinic content in a summer oil. But so far as phytotoxicity is concerned, it is with the percentage of unsulfonatable residue that the spray operator is chiefly concerned. The dormant and "delayed dormant" oils classified as "superior" by the New York State Agricultural Experiment Station must have a minimum "UR" of 90%. The "Acme" white oil (Standard Oil Company of Indiana) used in the 1948 Ohio *Phloem* necrosis spraying and described in the Ohio Agricultural Experiment Station's Special Circular #80⁴ has a "UR" of 96%. Other white oils vary in "UR" percentage from 95% to 98%.

Oil & Foliage Burning

FOLIAGE burning, or "pyrofoliation" resulting from spraying with petroleum products cannot be explained casually by stating that "oil burns foliage." Dr. R. P. Tucker, chemist of the California State Department of Agriculture, found that the chemically-active constituents of petroleum were not phytotoxic in themselves, but became so through their oxidization, catalyzed by sunlight.⁵ Tucker's data indicate that some of these reactive constituents in the unsulfonated petroleum are first oxidized into complex carboxylic acids and then into colloidal asphaltic com-

pounds: that "burning" takes place when about 0.5% of the asphaltogenic acids is formed.

Although the spray operator should be concerned with the presence of the aromatic hydrocarbons, this definitely does not mean that a petroleum oil high in aromatics can never be used safely in spraying. Some of the emulsifiable DDT concentrates consisting of DDT in a high-solvency xylene-type aromatic hydrocarbon have been used quite safely for control of corn borer and potato insects. In these cases, the aromatic solvent was selected carefully and the rate of application and type of spray dispersal equipment accurately controlled.

It should be remembered that the solvents high in aromatic hydrocarbon content, or "burning potential," are also high in volatility, and when applied under the proper conditions, disappear rapidly from the leaf surfaces before oxidization and possible foliage burning can take place.

A highly-volatile aromatic petroleum solvent of DDT, for instance, can be used successfully when the distance from the spray nozzle to the foliage is short enough that evaporation of the solvent-carrier will not take place too rapidly and before the DDT crystals are located on the foliage surface. The purpose of the petroleum in this case is two-fold; first, it is a primary solvent that changes the DDT crystals temporarily into a sprayable liquid; second, it is the carrier, or vehicle from spray nozzle to leaf surfaces. When both of these functions have been completed, the sooner the petroleum is dissipated the better. Then the insecticidal crystal comes out of solution, and attaches itself to the leaf surface. But in applications involving longer distances, this same volatility can become a handicap. For instance, if a straight xylene-DDT spray were applied from the ground and directed to the tops of eighty-foot trees on a hot dry day, the volatile xylene would disappear by evaporation many feet from the mark, leaving DDT crystals "hanging dry" in mid-air. Evapora-

tion is retarded when the original xylene-DDT mixture is amplified or filled out with the less-volatile, low aromatic petroleum adjuvants such as white oil. Thus, effective spray coverage at nozzle-foliation distances greater than fifteen feet may be obtained.

In brief, every spray prescription containing petroleum must be compounded carefully on the basis of the particular problem involved. Actually, with proper precautions, foliage may be sprayed safely with many of the high-aromatic petroleum oils, undiluted and unamplified, even though such procedure may not be recommended for general spraying.

The Solvents

AROMATIC hydrocarbons are essential in a good solvent because of their "receptive" or "unsaturated" capacity. Xylol is capable of absorbing more DDT crystals than Russian mineral oil because xylol is not "saturated." A gallon of xylol will easily absorb a pound of DDT technical crystals; a gallon of Russian mineral oil will not.

Although xylol is not the most receptive solvent, comparatively, it is relatively inexpensive, readily available, and has a reasonably high solubility quotient. For instance, 100 ml. of xylol will take up 57 gr. of technical grade DDT. Other "primary solvents" having a higher capacity, such as cyclohexane (116 gr. per 100 ml.) and benzene (78 gr. per 100 ml.) are not as satisfactory as xylol because of unavailability in certain sections, high volatility or flammability.

Kerosene has a maximum DDT solubility of about 5% by weight at room temperature. It would be impossible to dissolve a pound of technical grade DDT in a gallon of kerosene under ordinary temperature conditions. Kerosene will not "take" the DDT crystals in amounts of over approximately 6 ounces per gallon. Many spray operators using mist-applicators have had experience with excessive DDT solids in the tank from overloading a straight kerosene solution on a cool day. Kerosene's molecular structure makes it unable to take

(Turn to Page 98)



DR. H. B. SIEMS
Heads Research Committee



DR. K. D. JACOB
Appears on NFA Panel



ALLEN J. ELLENDER
"Gov't. Role in Agriculture"

NFA

**Annual Meeting
Greenbrier Hotel
June 12, 13, 14, 1950**



**Hundredth anniversary of
the industry is central
theme; speakers to re-
view past, discuss future
of U.S. fertilizer industry**



DR. R. M. SALTER
B.P.I.S.A.E. Chief Speaks



H. H. TUCKER
Member of Research Panel



S. D. GRAY
Presents Potash Viewpoint



OPENING on June 12 at the Greenbrier Hotel, White Sulphur Springs, W. Va., the annual convention of the National Fertilizer Association was to feature speakers representing government agencies, agriculture, the press and the fertilizer business.

A meeting of the NFA Plant Food Research Committee was scheduled for 10 a.m. on Monday, June 12, as the opening session got under way. "The Fertilizer Industry and Grassland Farming" was the subject for discussion by the Pasture Subcommittee, with participants including James A. Naftel, Pacific Coast Borax Co.; Malcolm H. McVickar, Chief Agronomist, NFA; Fielding Reed, Institute; and Borden S. Chronister, Southern Manager, National Potash Chief Agronomist, Southern Div., Barrett Div., Allied Chemical & Dye Corporation.

Another panel scheduled for the meeting was composed of the NFA Plant Food Research Committee discussing "A Century of Progress in Compounding and Utilizing Fertilizers." Participating in this program

were Dr. H. B. Siems, Director of Research, Plant Food Division of Swift & Co., Chicago; S. D. Gray, northeast manager of American Potash Institute; H. H. Tucker, director of the Coke Oven Ammonia Research Bureau, Columbus, Ohio; Dr. K. D. Jacob, head, Division of Fertilizer and Agricultural Lime, B.P.I.S.A.E., U. S. Dept. of Agriculture, Beltsville, Md.; and Vincent Sauchelli, director of Agriculture Research, Davison Chemical Corp., Baltimore, Md.

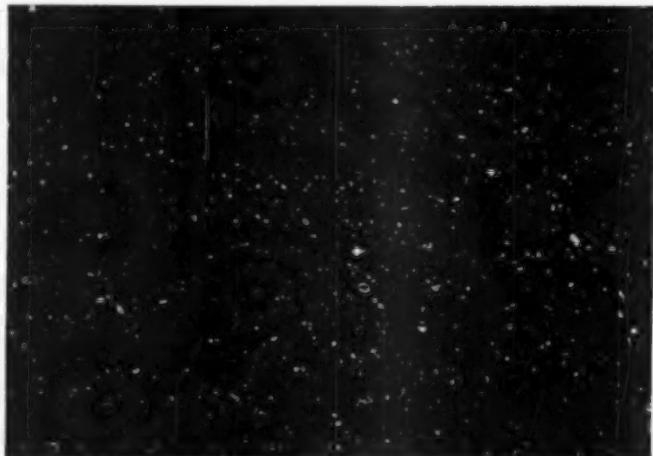
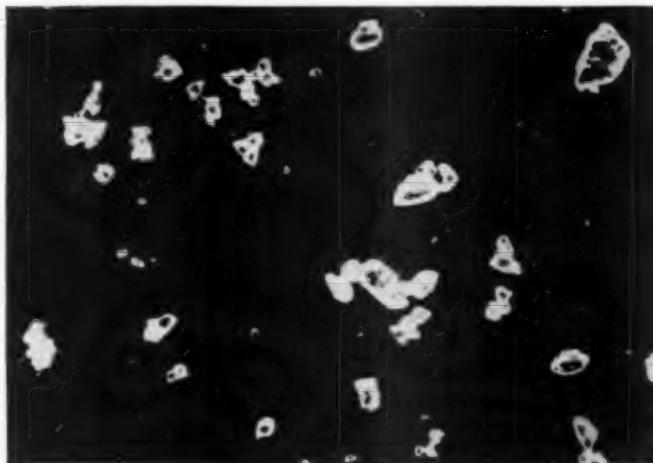
Other speakers scheduled to appear included Dr. Russell Coleman, president of NFA; Ray King, Georgia Fertilizer Co., Valdosta, Ga., chairman of the NFA Board of Directors; Dr. Paul D. Sanders, editor *The Southern Planter*, Richmond, Va.; Dr. Robert M. Salter, Chief, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Dept. of Agriculture, Washington, D. C.; and Ralph Robey, chief economist, National Association of Manufacturers.

The element of "surprise" was part of the program regarding the banquet scheduled for June 13.

A New Zealander tells How Agriculture "Down Under" uses Colloidal Sulphur Suspension

The photomicrographs shown below, each magnified 800 times, serve to compare finely dispersed state of the colloidal suspension (lower photo) with an air-milled micron-size wettable sulphur seen in the top picture. However, as the

author states, photomicrographs of such suspensions are rather unsatisfactory because of movement of suspended particles and also because smallest particles are not recorded on the photographic plate.



VARIOUS elemental sulphur preparations marketed as pastes or wettable powders, have been used in fungicidal sprays by New Zealand fruitgrowers for more than thirty years, principally against apple scab, and powdery mildew, as well as for brown rot of stone fruits. New Zealand is probably unique in its use of elemental spraying sulphur as types such as precipitated, sublimed, flotation and wettable sulphur powders and pastes have been superseded by the finer "colloidal sulphur" suspensions, with much improved field performance.⁵

The extensive use of colloidal sulphur suspension in New Zealand resulted from the investigations of Dr. G. H. Cunningham³ of the New Zealand Plant Diseases Division.

The country's total fruit harvest of about three to four million bushels per year, is diversified. Apples are the major fruit crop. A surplus of one-half to one million bushels is exported to England each year.

Climatic conditions in the five principal apple growing areas are varied, ranging from dry to very humid. The annual rainfall is about 20 inches in Otago in the South Island and 80 inches in Auckland in the North Island.⁴

Fungal infections can be very severe. In some years fruit crops of unsprayed check trees at Government experimental orchards have been recorded as 100% infected with apple scab,⁵ this degree of infection, however, is not usual. The standard orchard spraying schedule developed by the New Zealand Horticulture and Plant Diseases Divisions, usually enables the average efficient orchardist to reduce apple scab infection on the more susceptible varieties to 5% or

by

T. J. McKee

Fruitgrowers Chemical Co., Ltd.
Mapua, Nelson, N. Z.

less, which is regarded as commercial control. Today, with revised spraying schedules, improved species and means of application, apple scab and powdery mildew are seldom a major problem on well managed orchards.

In New Zealand, as in any country, orchard spraying programs are subject to local variations, but for apples most growers use Bordeaux mixture at green-tip, weak lime sulphur solution from open cluster to pink stages, and for subsequent sprays colloidal sulphur (or colloidal sulphur with weak lime-sulphur solution) in combination with compatible insecticides.¹ Dusting is not practiced by New Zealand fruitgrowers.

All elemental sulphur preparations were imported into New Zealand until 1937, when the manufacture of colloidal sulfur was initiated by Fruitgrowers Chemical Co., Ltd., at Port Mapua. Since 1941, the Mapua plant has supplied virtually the whole New Zealand market. Sold under the trade name "Colsul" the New Zealand product is a fairly viscous but easily miscible white paste formulated with wetting agent, and a small quantity of suspending agent, to ensure satisfactory storage over prolonged periods. The product contains no inert solid mineral fillers. The specific gravity of a paste containing 40% sulphur is 1.27. The actual sulphur content of most of the output is 40% by weight (W/W), but in areas near the Mapua plant where transportation does not figure largely in the cost, suspensions containing 25% sulphur are marketed. Both products are shipped in wax-lined wooden kegs of various sizes from 28 lb. to 224 lbs. For all practical purposes the concentrated suspension stores indefinitely without particle

growth, or agglutinating into large masses of particles.

On dilution the New Zealand colloidal sulphur forms a milky white suspension which is very stable and requires many days for complete settling. The product is unaffected by hard water. Colloidal suspensions prepared by the New Zealand process consist of spheroidal particles the bulk of which are within a very narrow particle size range, generally about 0.25 microns to 1.5 microns, averaging about 0.5 microns. No very precise determinations have been made of the particle size distribution, but microscopic examination and sedimentation tests indicate that all visible particles conform approximately to this estimate, and the percentage of grossly oversize particles is very low. In dilute suspension, the majority of particles are freely dissociated, and being of such small size, a large percentage pass through most filter papers. Suspensions exhibit strong Brownian movement. Very dilute suspensions containing 10 parts per million colloidal sulphur are slightly turbid.

Photomicrographs of colloidal sulphur suspensions are unsatisfactory, on the whole, due to Brownian movement of suspended particles, and because the smallest particles are not recorded on the photographic plate, or subsequent reproductions. Nevertheless, comparison may be made between the finely dispersed state of the New Zealand product, and a typical micro-sized airmilled wettable sulphur powder, through the medium of photomicrographs.

Low Actual Dosage

HERE are numerous references in the literature emphasizing the relationship of reduced particle size of sulphur with its increased toxicity as a fungicide.^{3,5,7,8,9,15,16} These findings seem to be confirmed by the practical experience of fruitgrowers in New Zealand under widely varying climatic conditions, over a period of many years. Probably 30 million bushels of apples have been protected with New Zealand-made colloidal sulphur as the main elemental sulphur specific in the scab control program, since the product was adopted for general use.

The effect of reduced particle size and consequent increased surface area, rather than weight of sulphur applied, is demonstrated by the unusually low actual sulphur dosage employed successfully in New Zealand under varied conditions of rainfall, temperature, and humidity. After petal fall, commercial control of apple scab is usually achieved at strengths equivalent to 0.83 lbs. actual sulphur per 100 U. S. gallons when used alone, or 0.6 lbs. actual sulphur when used with very dilute lime sulphur. At the Research Orchards in Auckland and Hawkes Bay, Taylor and Atkinson¹², have shown cover sprays of very weak lime sulphur (1 gal. to 200 gal. = 0.1% polysulphides) combined with colloidal sulphur paste equivalent to 0.42 lbs. actual sulphur per 100 U. S. gallons, have given effective control of apple scab from year to year, once control has been established. This is of course following the use of the standard program

TABLE I

Product	Total Sulphur lbs. per 100 Imperial Gals.	Equivalent total sulphur lbs. per 120 U. S. Gals.	% Apple Scab
N. Z. Colloidal Sulphur	0.5 lb.	0.42 lb.	10.0
Micronized Sulphur	1.0 lb.	0.83 lb.	11.8
Wettable (Sample A)	1.0 lb.	0.83 lb.	15.7
Wettable (Sample B)	1.0 lb.	0.83 lb.	12.1
Dry Colloidal	1.0 lb.	0.83 lb.	12.7
Non-treated	Nil	Nil	33.0

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where efficient methods of spray application are employed.

During the growing season, from the period petal fall to harvest, as many as eight applications of colloidal sulphur are made, either alone on lime-sulphur sensitive varieties, or in combination with weak lime sulphur on hardier varieties. Colloidal sulphur is used freely in combination with arsenate of lead and wettable DDT powders, and there does not appear to be an unfavorable reaction with either material.

The New Zealand type of colloidal sulphur suspension exhibits good adhesion and retention on most plant surfaces. Under New Zealand conditions Cunningham⁸ found in 1932 coarser forms of sulphur were readily removed from foliage by wind and rain but colloidal suspensions showed strong adhesion.

The field tests of research stations and the extensive practical experience of fruitgrowers in New Zealand seem to show that colloidal sulphur pastes are more effective than the coarser forms of elemental sulphur. It has been noted by Hamilton and Palmeter⁹ sulphur pastes are more effective than dry wettable sulphurs, and sulphurs of small particle size are generally more effective than those of larger particle size.

In an orchard spraying experiment conducted by G. G. Taylor¹³ of the New Zealand Plant Diseases Division during the 1939/40 season, New Zealand-made colloidal sulphur paste was compared with imported dry wettable preparations, all of substantially larger average particle size. The results are shown in Table I. The materials used on individual test plots were the only fungicides used during the whole growing season. So that differences in effectiveness would be shown up, sprays were applied at low dosages and only four applications were made during the whole spraying season, instead of the usual eight or ten applications.

The variety Delicious was selected for the experiment.

Although infection on check trees was very light during the 1939/40 season, under the conditions

of this experiment about half the dosage of colloidal sulphur paste was required to obtain control of a similar order as the dry wettable powders.

In New Zealand, much stress has been placed on the timing and application of early sprays which have been shown to influence the degree of late infection. Most growers find Bordeaux mixture a very satisfactory foundation spray at early "green tip." The general tendency is to use lime-sulphur sparingly and at great dilution. It is generally recognized colloidal sulphur (or colloidal sulphur and weak lime-sulphur solution in combination) is not a scab eradicant but merely a protectant. Nevertheless, the standard New Zealand program has given a fair measure of control. Table II shows three years results recorded at the Government Research Orchard, Appleby, Nelson, using for Delicious variety the fungicidal spray program shown at the bottom of this page.

The 1942 crop was light on both sprayed and unsprayed plots, and there was an exceptionally light scab infection on the check trees.

The same spray schedule was used again at Appleby Research Or-

chard on Delicious variety during 1948, with one slight modification. Lime-sulphur solution was used at a dilution of 0.2% polysulphides at open cluster to pink stages, instead of at 0.13%. Apple scab infection was 4.5% on sprayed trees, and 87.6% on unsprayed check trees.

For lime-sulphur sensitive varieties such as Cox's Orange Pippin, lime-sulphur solution is not generally used after pink stage. On this variety, colloidal sulphur alone after petal fall at 0.8 to 1.25 lbs. actual sulphur per 100 U. S. gallons right through the season has given very satisfactory control of apple scab. At Appleby Research Orchard, scab infection of Cox's Orange variety on sprayed plots averaged 1.8% during four recent years. In these experiments the only post-blossom fungicidal sprays were colloidal sulphur. At the same orchard, during the 1948 season, an attempt was made to induce fruit and foliage damage by application of one spray at several times normal concentrations. Applications up to 12 lb. 40% colloidal sulphur paste per 100 gallons (Imp.) (i.e. four to six times usual dosage) produced no

(Turn to Page 87)

TABLE II

Year	Apple scab % on Delicious variety	
	Sprayed	Unsprayed
1945	5.8	59.6
1943	3.9	72.0
1942	Nil	14.1

Period of Application	Spray Treatment		
	Fungicide	Dosage*	
Early green-tip	Bordeaux mixture	10 lbs. copper sulphate 8 lbs. hydrated lime	per 100 gal.
Open cluster to pink	Lime sulphur solution [†]	1 gallon	per 100 gal.
	Colloidal Sulphur	2 lbs. 25% Paste	per 100 gal.
Petalfall	Lime sulphur solution [†]	1 gallon	per 200 gal.
	Colloidal Sulphur	2 lbs. 25% Paste	per 100 gal.
14 days later	Ditto		
18-21 day intervals	Ditto		
throughout season			

* Based on Imperial Gallons.

† Containing 15% Polysulphides



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5th Annual Meeting of American Plant Food Council



CLIFTON A. WOODRUM
APFC President

THE fifth annual convention of the American Plant Food Council was scheduled to be held at the Homestead Hotel, Hot Springs, Va., with a program consisting of talks by prominent statesmen, agricultural leaders and writers; and the awarding of prizes to winners in the nation-wide essay contest sponsored by the Council and the National Grange. Dates of the meeting were June 30 to July 2nd.

Among the speakers named on the program were Dr. Douglas S. Freeman, Richmond, Va., author, historian and Pulitzer Prize winner; U. S. Senator Sprell L. Holland,

Florida, member of the Senate Committee on Agriculture and Forestry; W. R. Thompson, Associate Leader in Extension Agronomy, Mississippi State College, and Clifton A. Woodrum, president of the American Plant Food Council, Washington, D. C.

The awarding of prizes was to be one of the highlights of the Hot Springs convention. Assistant Secretary of Agriculture, Knox T. Hutchinson, chairman of the National Board of Judges, was to make presentations to youths who entered the best essays on "Soil Fertility and the Nation's Future," in the coast to coast contest. Albert S. Goss, Master of the National Grange was scheduled to speak in connection with the awards, which were to total \$10,000. (National prizes included: First, \$1,000; Second, \$500; Third, \$400; Fourth, Fifth and Sixth, each \$300). The National winner, announced at the meeting, was to read the winning paper at the convention as part of the program.

Other members of the Board of Judges included Dr. Hugh H. Bennett, Chief, Soil Conservation Service, U. S. Dept. of Agriculture; Miss Lois M. Clark, Assistant Director, Division of Rural Service, National Education Association; Dr. W. Y. Spanton, Chief, Agricultural Educa-

tion Service; and Dr. M. L. Wilson, Director of Extension Work, U. S. Dept. of Agriculture.

Joseph A. Howell, President, Virginia-Carolina Chemical Corp., Richmond, Va., was chairman of the convention committee, with the assistance of A. F. Reed, vice-president, Lion Oil Co., El Dorado, Ark.; R. C. Simms, President, Naco Fertilizer Co., New York City; Paul Speer, Vice-President, U. S. Potash Co., New York City; Fred J. Woods, President, Gulf Fertilizer Co., Tampa, Fla.; and W. T. Wright, Vice-President, F. S. Royster Guano Co., Norfolk, Va.

SEN. S. L. HOLLAND

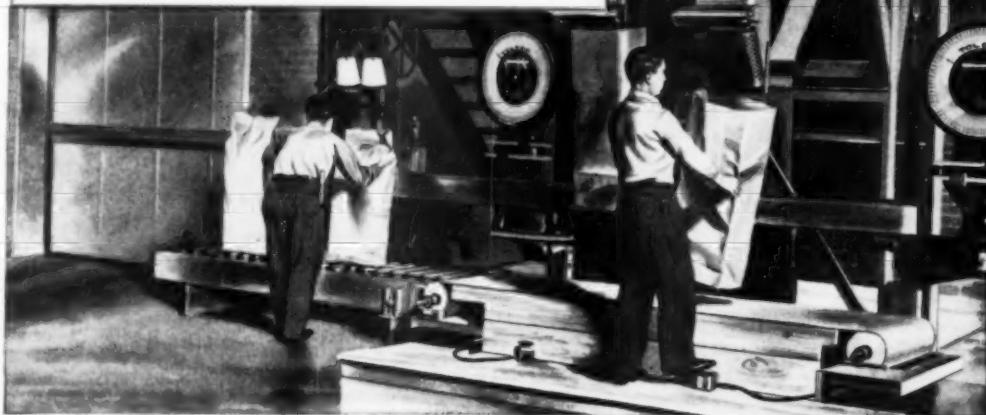


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OPPOSITION to the use of fertilizers is not new. As far back as 1846, only a few years after Liebig's "Organic Chemistry and Its Application to Agriculture and Physiology" and John Bennett Lawe's first production of super-phosphates, the following lines appeared in the famous British weekly, *Punch*:

"But chemistry now into tillage
we lugs,
And we drenches the soil with a
parcel of drugs,
 Makes each fallow
 Physic swallow—
All we poisons, I hope, is the
slugs."

The similarity of this century-old viewpoint with the more prosaic opinions of to-day's humus-only crusaders needs no comment.

Whenever an entirely new idea impinges upon ancient practices, deep-rooted reaction is inevitable, and the attitude of the 1846 poet is normal again. But since then there have been more than a hundred years of fertilizer research—continuous plot-testing and long-term, large-scale field-testing; hundreds of thousands of acres have been regularly and beneficially dressed with fertilizers; and in most parts of the world a new chemical industry has been built up to supply ever-increasing quantities of Nitrogen, Phosphoric Acid, and Potash. We have had to learn how to fix the nitrogen of the air because the chemical nitrogen from mineral deposits and by-product sources was not available in sufficient quantity; we have developed new ways of processing phosphate rock, and we have opened up vast reserves of potash salts. Yet reaction and resistance are still with us, or, more accurately, still against us.

In Britain during the last few years the opponents of fertilizers have steadily increased their activity. Books in which chemical fertilizers are described as soil poisons or "Devil's Dust" have sold widely—one, indeed, was recommended by the Book Society. At least two anti-fertilizer journals, one quarterly and one monthly, are published. A society pledged

Because attacks on the use of commercial fertilizer materials in England are so similar to such propaganda circulated in the United States, Agricultural Chemicals believes that what author Hopkins reports is of significance to American readers. At least, we are sure that the following article will be of interest to our readers.—The Editors.

ANTI-FERTILIZER ACTIVITY in BRITAIN

by

Donald P. Hopkins

H. & T. Proctor, Ltd.,
Bristol, England

to carry out experiments with an anti-fertilizer bias has been formed, and is supported by private subscriptions; another organization seeks to establish a chain of regional groups of farmers, small landholders, and gardeners to further the policy of raising crops exclusively with manures and composts. By these methods, a relatively small section of the public is able to maintain a steady stream of anti-fertilizer propaganda.

On the whole, British soil scientists and fertilizer producers have ignored this nagging campaign. Argument and open debate have been regarded as undignified, perhaps because the attacks have usually been made in a highly polemical atmosphere; the scientists in particular have hesitated to return fire. Leaders of the fertilizer industry have felt that counter-argument would merely give the attackers more limelight. It has been left to a few individuals to make occasional protests. As a matter of conjecture, it is hard to believe that the pioneers of the fertilizer idea would have been content to follow this negative policy of indifference. They probably would have hit back fearlessly. An ever-increasing number of people to-day are re-interested

themselves in the soil, and psychologically this rather emotional "back-to-the-soil" mentality seems to be the ideal reception ground for the plausible anti-fertilizer thesis; for the modern presentation of this thesis is plausible. Moreover, it is often presented attractively and colorfully, in terms that the ordinary reader can understand. With this in mind, it seems to be a mistake not to reply; to risk losing the debate by default. If belief in the fertilizer idea is strong enough, then it should be worth fighting for.

Act Upon Knowledge

If counter-attack is to be effective, a careful study of the general anti-fertilizer arguments is an essential preliminary. It is wrong to dismiss this organized opposition as faddism or crankism. The proposition that fertilizers are harmful has been accepted wholly or partially by quite a number of thoughtful people—usually because they have heard only one side of the story. People like this will not be "won back" by the kind of argument that would appeal to an audience of trained scientists; they have been persuaded against fertilizers by "popular" methods, and much the

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same tactics are necessary to reverse their opinions. It is not enough simply to state positive evidence for fertilizers; the weaknesses of the anti-fertilizer arguments and evidence must also be clearly exposed. In short, there are two essentials in countering anti-fertilizer propaganda — first, the realization that the jury is a jury of laymen and not technicians; second, an intimate knowledge of the opposition's thesis so that it can be answered point by point.

The main thesis against fertilizers is, of course, the idea that fertility must be maintained exclusively by "natural" methods and with "natural" materials. Lime is natural, animal and vegetable manures are natural, fertilizers of organic origin are natural—but let the word "chemical" or "synthetic" precede the word "fertilizer" and Nature is being raped! It is held that all the problems of plant-growth will work out their own solutions if we look after the soil's humus supply: pest attack will be kept under control by "the balance of Nature," diseases will not spread to epidemic dimensions, the food values of crops both for man and animals will reach optimum and Nature-intended levels. Scientists and fertilizer producers are jointly indicted for replacing "living" manures with "dead" chemicals. As proof of these sweeping claims, we are told that (a) the use of insecticides and fungicides has greatly increased, (b) the general health of men and animals has steadily declined, and (c) much once-rich soil has become less fertile or been completely lost, all since the introduction of chemical fertilizers.

To dismiss so violent and extremist an attack as this with terse denials or contemptuous silence may be satisfying, but it does not convince those who feel that there is "something in it." Our duty is not to merely satisfy ourselves that we are right, but also to convince the general public. Moreover, the previous paragraph merely presents the main thesis in tabloid form. This thesis is ingeniously supported with a number of subsidiary theses, each of which—at any rate as presented in the all-humus school's writings—is

highly plausible. These other arguments emphasize the biological aspects of soil fertility and plant nutrition—the roles of soil bacteria, earthworms, mycorrhizal fungi, and so on, subjects in which the layman will not readily detect false generalization or illogical deduction.

A PARTICULARLY false plank of the anti-fertilizer *credo* is the monotonously repeated statement that fertilizers are sold as complete substitutes for manures. The soil chemist is always the villain of the piece who contends that NPK is enough, that humus is dispensable. This misrepresentation cannot be too strongly or too frequently refuted. Orthodox soil science has consistently stressed the dual and balanced roles of NPK and humus, and we should not allow our opponents to get away with the idea that they alone are the champions of humus and organic matter. Unfortunately, it is a popular opinion that fertilizers are advocated as manure replacements, and it would be foolish to deny that, while fertilizer consumption has increased in the past fifty or sixty years, so manure supplies have diminished. What is not generally appreciated is the fact that, to offset the decline in manure supplies, other and less direct methods of humus maintenance (green manuring, ploughing back of crop residues and cover-crops, etc.) have had to be adopted.

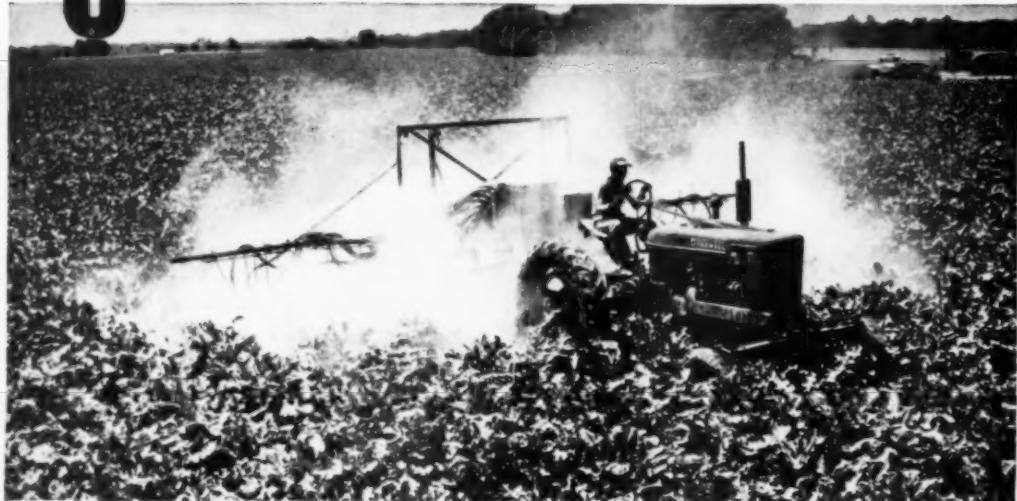
One of the British leaders of the anti-fertilizer school is so vehement on this point that he ascribes initial successes with fertilizers to the humus stocks in the soils, and he insists that "true" comparisons of fertilizer and manure treatments should have the fertilizer plots based on the sub-soil; in short, the partnership of humus is to be denied to fertilizer action! One might just as fairly insist upon conditions of drought so that the assistance of moisture is also withheld.

Whenever fertilizer sales literature or soil scientists' recommendations give the impression that humus does not matter, whenever it is complacently suggested that chemical nutrients are sufficient by themselves,

the door is wide open for anti-fertilizer propagandists. I do not mean that we should pay lip-service to humus or that we should discredit our products with lists of limitations; but, just as we advise liming to counteract soil acidity because we know that acidity reduces fertilizer efficiency, so we should consistently advise attention to humus maintenance by the return of waste organic matter because humus deficiency will also reduce the effectiveness of fertilizers. But we should make it clear that the plant is Nature's bridge between the mineral and organic worlds, that the plant builds up organic matter by consuming simple "chemical" nutrients in the first place; so that, in this sense, fertilizers are indirect providers of humus.

The specious argument that the fertilizer age has seen a vast increase in the use of sprays and dusts is easily demolished. The use of these other agricultural chemicals has expanded largely because they were not available to previous generations. One might as well argue that the use of postage stamps has greatly increased since fertilizers were invented. This, too, is a chronological fact but the logical connection is somewhat remote. It should not, however, be forgotten that another popular and general misconception is the idea that plant diseases are much more prevalent than they were fifty or a hundred years ago. It should be admitted that the modern search for new and specialized varieties of plants has sometimes led to the over-growing of a weakened species, and that this in turn has led to epidemics of exceptional severity. Also, the tendency for modern farms to specialize in a few crops under continuous cultivation rather than rotation has enabled pests or disease-fungi to build up into thriving populations. To control these greater risks, the demand for fungicides and insecticides has naturally increased. Nevertheless, the worst ravages of plant disease in agricultural records will still be found in the pre-fertilizer age, the most damning example being the potato blight famines of Europe—and particularly of Ireland—in the eighteen-forties.

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Nutrition Attacked

THE view that human health has generally deteriorated since fertilizers began to be widely used is, of course, a "crank" view. It comes from that earnest section of the anti-fertilizer school that is connected with nutrition faddism. It is only necessary to compare health and life statistics of modern countries where fertilizers are used with similar statistics of countries where agriculture is still based upon the return of wastes to the soil. The state of Japanese soil found by the U. S. Army and the necessity to set up large hydroponic farms to grow disease-free vegetables is a new and powerful piece of evidence that should be widely publicized.

The accusation that fertilizers cause a long-term decline in soil fertility, and in extreme cases lead to loss of the soil through erosion, has been strongly propagated in Britain, no doubt because there is practically no erosion in the islands. The British anti-fertilizer school is always ready to point to erosion in the United States as large-scale evidence of the results of over-using fertilizers! Unfortunately many people swallow this story, and recently one of our leading soil scientists used some American figures most effectively to show that the pre-erosion fertilizer applications in some of the worst U. S. erosion areas were negligible. We are also pointing out that soil conservation schemes in the U. S. include the use of fertilizers as an essential step in the re-building of badly damaged soils. The more facts we learn about American erosion problems, the more we in Britain can nail the lie that fertilizers caused such conditions!

As for the subsidiary arguments that are put forward, perhaps there is still space to deal briefly with these. Undoubtedly a large and active population of useful micro-organisms is an essential property of a rich soil, and the more humus there is in the soil the more these bacteria are likely to be encouraged. The anti-fertilizer school argues that the regular use of fertilizers is *ipso facto* associated with a dwindling humus reserve—therefore, the bacteria numbers must

fall steadily. There is, of course, no evidence of this. On the contrary, a supply of available nitrogen is necessary to encourage the work of the humus-forming bacteria, whether in the soil when stubble is plowed in, or as held in the compost heap. The fact that most of the beneficial bacteria are inhibited by soil acidity is also used as an argument against fertilizers, particularly against sulphate of ammonia; but it has long been recommended that when this fertilizer is regularly used, liming must be carried out from time to time to keep the soil pH on the right side of 6. Indeed, the rapid response of crops to sulphate of ammonia dressings is in itself a strong reply to the bacterial argument; for the help of bacteria is first necessary to nitrify the ammonium ions to nitrate ions, and if fertilizers gradually inhibited soil bacteria, sulphate of ammonia would gradually become an inert source of nutrient. It is also argued that most chemical fertilizers inhibit the growth of soil micro-fungi but the evidence for this view comes from the fact that quite different kinds of fungi have been inhibited in test-tube cultures by various solutions. This childish piece of argument by analogy must be mercilessly exposed whenever it turns up. In one anti-fertilizer book that has enjoyed several editions in a few years, there are pictures of these test-tube experiments, but no space is used to point out to the reader that the fungi in the tubes are not soil fungi and that the inhibiting chemicals are not fertilizers.

It is true of course, that nitrogen-fixing organisms—the azotobacter, the blue-green algae, and the leguminous bacteria—will not do their work of fixation if there is a deficiency of available combined nitrogen in their environment. This is well known, but the anti-fertilizer school utilize it as if it were their own discovery. It is important to put over the facts that the average annual azotobacter contribution of nitrogen is not high, that except in very wet conditions that of the algae is small, and that it is not general fertilizer practice to supply nitrogen at all

heavily to leguminous crops. The layman must not be left to believe that nitrogenous fertilizers create their own necessity by stopping bacteria from getting nitrogen into the soil—this is one of those plausible anti-fertilizer theses that must be exploded.

The mycorrhizal fungi argument has been much stressed in Britain. In forestry research work in Dorset conifer seedlings could not be successfully established despite the use of basal fertilizers; then compost dressings were tried and successful development occurred. It was shown that the compost had stimulated the extensive growth of the parasitical root fungi, the mycorrhiza, and it is claimed that these fungi provide plants with another method of nutrition additional to the normal absorption of the soil solution. From this specialized piece of evidence, it is sweepingly generalized that almost all plants depend for fully healthy nutrition upon this mycorrhizal "bridge" and that this development cannot naturally occur in the presence of "chemicals." To let this ingenious argument go by default is most dangerous, for, as presented in anti-fertilizer literature, it seems a convincing piece of scientific evidence. The answer lies in the work of Frank on mycorrhiza in which he showed that this symbiosis is not of general importance to plants, but is of exceptional importance to plants that habitually grow on heaths and moors, plants that have to thrive against dry soils in the summer and water-logged conditions in the winter. The mycorrhizal mode of indirect nutrition has evolved out of these plants' exceptional struggle for existence. It is sheer nonsense to claim that what is true for the conifer seedling is also true for a cabbage. Furthermore, the Dorset evidence came from poor heathland soil that could not have been used for economic agriculture; this soil's past history was of alternate drought and water-logging, and it is hardly surprising that humus addition via composts was its primary requirement for any kind of planned plant growth. American soil students

(Turn to Page 91)

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Manufacturers of Organic Chemicals

Shortages Continue as Industry Prepares for 1950 INSECTICIDE NEEDS

SHORTAGES of the major insecticidal chemicals seem to be the order of the day for this season. Technical DDT, technical BHC, 2,4-D acid, pyrethrum, and in some areas parathion, are on the short list and as of this writing, the supply appears to be not too adequate in view of the potential insect infestation regarded as likely.

Although there is not sufficient supply of technical DDT and BHC to provide for the current demand, actually production has stepped up appreciably. There is no doubt that if additional raw materials were available, production would have been sufficiently increased so that the materials would not have been as tight as they appear to be. March production of technical DDT was 4,374,000 lbs. while February production was 2,868,000 lbs. and January was 3,364,000 lbs. BHC production during March was 4,320,000 lbs. while February production was 3,181,000 lbs. and January production was a mere 2,369,000 lbs.

Many explanations are offered by members of the industry concerning the reasons for the current shortage, but some of the most prominent of these include:

1) Stockpiles of finished insecticides were nearly exhausted after the sudden demand last year caused by the great infestation of both cotton and corn insects. (It will be recalled that last June and July there was much activity for the technical materials in a desperate last-minute effort to get finished formulations ready for the field.)

2) Increased warnings and reports by the U.S.D.A. and many state and county agencies that 1950 would be a year of maximum insect infestation.

3) The usual unwillingness of the insecticide distributor, dealer and consumer to take in any amount of insecticides as insurance against an anticipated requirement. The problems faced in the maintenance of large inventories by the manufacturer of the technical material and the concentrated formulations are such that management having been overstocked in previous years was taking no chances on a recurrence, in spite of the factors mentioned above. Another important factor was that prices of the technical chemicals last fall were not conducive to full scale production.

4) The retarding influence exerted by various strikes, particularly those of coal miners. Benzene, affected perhaps more by the coal strike than any other chemical raw material, actually had been in rather poor supply during the 6 to 8 month slowdown in coal production before the complete stoppage. Thus, when all coal production halted for two months before the strike was settled, benzene production was affected tremendously.

Leaders in the chemical industry, familiar with this supply situation, estimate that there is a current shortage of between 10 and 15 million gallons of benzene. It has been realized for some time that benzene from coal tar products is not adequate to take care of the increasing U. S. demands for benzene. Production of so-called "synthetic benzene," that is from the petroleum source, now accounts for less than 5% of the

total output, but it is expected that benzene from this source will be increasingly important in years to come. (There are now at least two plants producing the synthetic benzene.) It is probable that the benzene shortage contributed as much to the current shortage of insecticides as any other single factor involved.

5) The seasonal increase in the demand for chlorine is responsible for part of this current shortage. Consumption of chlorine always increases materially in the spring and summer because of the heavy demand for this commodity for use in purification of water and similar uses.

Another contributing factor to the shortage of chlorine is the back-up in the chlorine producing plants. Industry spokesmen point out that there has been a back-up of caustic due to the general decline in domestic consumption as well as the heavy falling off in export demand.

Export Shipments Low

EXPORT shipments for both DDT and BHC, technical and in formulations, are practically at a standstill because domestic producers wish to supply the imminent demand for finished insecticides. Most industry spokesmen feel that current shortages may extend well into July or August since by this time the urgent demand will be awaiting attention as the domestic season is finished. Although the resale market on the technical materials is practically nonexistent, there have been reports of sales made at prices well above the current market figures on these materials.

Production of 2,4-D has been partially affected by raw material shortages, but the heavy inventories

(Turn to Page 93)

by

Melvin Goldberg

Pesticide Advisory Service
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AGRICULTURAL CHEMICALS

Parts A, B, & C Completed; July 10 set for reconvening

TOXIC RESIDUE HEARINGS

by
John D. Conner

FOllowing the completion of parts A, B, and C on May 22nd, the Food & Drug Administration hearings on toxic residues were adjourned until July 10th. At that time the taking of evidence in relation to the toxicity of the various pesticidal compounds will begin.

The last day of the hearing prior to adjournment was highlighted by the testimony of Dr. A. J. Lehman, Chief, Division of Pharmacology, Food and Drug Administration. In his testimony Dr. Lehman grouped the majority of the insecticides, fungicides and herbicides, previously mentioned in the hearing, into various classifications in accordance with his opinion of the toxicity and health hazard involved in the use of each. Only a small number of the insecticidally or fungicidally active compounds were classified as non-deleterious. Dr. Lehman's opinion concerning use of seed treatments and soil fumigants confirmed that of earlier witnesses. He declared that there is no uptake into the edible portion of the plant from these treatments. Dr. Lehman also expressed the opinion that materials like tetraethyl pyrophosphate decompose quickly into harmless substances so that there is no public health problem involved from residues of such products. The majority of the other compounds were classified as those which are not likely to result in injury to public health unless used excessively; those which are more hazardous and therefore require a strict quantitative tolerance; and those which he did not classify because of lack of information.

Following Dr. Lehman's testimony, Dr. Edwin T. Laugh, also of the F.D.A. Division of Pharmacology, presented testimony on the occur-

rence of various substances in the food supply.

Miss Faith Clark, food economist of the Bureau of Human Nutrition and Home Economics, U.S.D.A., was the last witness before adjournment. She presented results of a special survey showing the consumption of fruits and vegetables in four cities.

Industry Testifies

THE presentation of evidence by witnesses for the various chemical companies was completed on May 22nd just before the testimony of Dr. Lehman. This portion of Part A had started on May 1st. Dr. Merrill M. Darley, Allied Chemical and Dye Corporation, was the first witness here. He reviewed the historical development of lead arsenate and paris green and submitted a compilation of recommendations relating to arsenicals in 75 of the state spray schedules.

Testimony of previous witnesses on the use of ryania was reviewed by Harold Noble, S. B. Penick and Company, New York. Included in Mr. Noble's testimony was a discussion of two synergists, piperonyl cyclonene and n-Propyl Isome.

In his testimony, Dr. Philip P. Paul, U. S. Rubber Company, described the chemistry, production and methods of analysis of "Sperton" and "Phygon" and "Aramite." Also on behalf of U. S. Rubber Company, Dr. H. Douglas Tate discussed the use of these compounds.

Dr. Richard H. Wellman, of Union Carbide and Carbon Corp., New York, producer of glyoxalidine, discussed New York recommenda-

tions for its use on apples and cherries. He reviewed the development and composition of "Crag 169," "640" and "658," the latter being the only one of these products which is now marketed commercially. Dr. Fred R. Whaley, also of Union Carbide and Carbon, supplemented Dr. Wellman's testimony on "Crag 658" and gave its empirical formula. William N. Moore, of the same company, discussed methods of residue analysis for "Crag 658" while Dr. Jacob N. Wickert reviewed the development of 2-heptadecyl glyoxalidine, and methods of residue analysis.

Dr. John L. Horsfall, American Cyanamid Company, discussed the entomological action and use of calcium cyanide and parathion. Dr. Philip R. Averell, of the same company, discussed the procedure for making residue determinations and experimental work relating to translocation, absorption, and disappearance of parathion residues. Dr. Bruce D. Gleissner summarized publications dealing with parathion. Other witnesses for American Cyanamid Company discussed bioassay methods for determining residues, and volatility studies. One witness covered the application of industrial hygiene to the working environment in a citrus grove during and after spraying of parathion.

Dr. George R. Ferguson, Geigy Company, Inc., discussed the special conditions applicable to the control of codling moth, the difference between purified and technical grades of DDT, and distinguished between DDT and DFDT.

Thomas F. Cleary of Geigy Chemical Company discussed methods of analysis of "E-605" and of "Meta-

(Turn to Page 83)



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The Listening Post

Study Seed Protectants on Peanuts

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of **AGRICULTURAL CHEMICALS**. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller



SCARCITY of labor during the late war and the sharp rise in peanut acreage, has accelerated the change-over from use of hand-shelled to machine-shelled seed. The rapidity with which this change was made contributed to many of the troubles encountered. A lack of technical information forced operators of peanut shellers to become experimentors, with quite a few of them learning how to prepare good seed for planting, through trial and error. However, complaints are still heard occasionally that poor seed have been the cause of unsatisfactory stands.

Within the past 10 years, experiment stations in peanut-growing States have aided in the improvement of peanut culture by testing many seed protectants under a variety of conditions. At the present time practically 100 percent of the peanuts planted in the Southeast are treated, but the practice has not solved all the seed problems, for poor stands still occur at times. It is possible that the treatment fails to prevent seed rot under some conditions.

This is the situation according to Coyt Wilson, of the Alabama Agricultural Experiment Station, who reports tests with various seed protectants in that State from 1944 to 1949.

(In Table 1 are listed the trade names, the active ingredient, and the standard dosage of the seed protectants tested 2 years or more in Alabama. Several others have been screened out as a result of one year's work.)

The following account is abstracted from his report.

Experimental Data: Unless otherwise stated all tests were made with runner peanuts. The machine-shelled seed were prepared in the U. S. Department of Agriculture sheller, which produces a sample containing a few unshelled seed and about 5 percent splits. One-pound lots and the appropriate amount of the seed protectant were shaken together in paper bags for approximately one minute. The treated seed were then

placed on a screen and all splits, unshelled seed, and moldy seed were removed by hand. Lots of 100 seeds were picked at random from this cleaned sample and hand planted in one-row plots of 20 to 25 feet in length. Usually each treatment was replicated four times in a randomized complete block design; in a few tests there were six replications. Except for those experiments in which storage was a factor, the seed were treated and planted immediately after shell-

ing. There is an opinion prevalent among peanut growers that seed deteriorate rapidly after shelling. For this reason they insist that seed not be shelled until just a few days before planting time. Experiments in several States, including Alabama, however, have shown that if proper storage conditions are provided, planting seed can be shelled safely two or three months ahead of planting time.

Several factors enter into the selection of a seed protectant for a particular seed. One of the most important factors affecting choice of a seed protectant is permissible latitude in dosage. This is evident in the

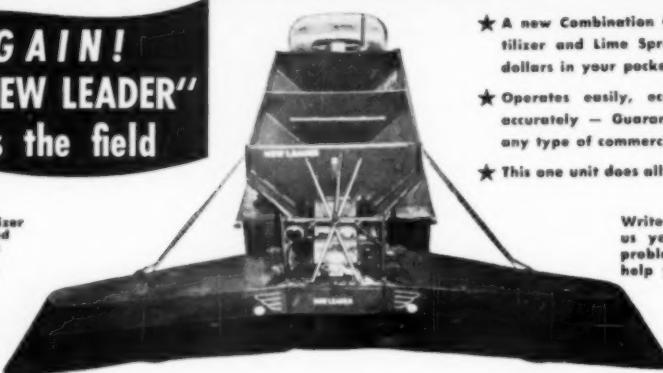
TABLE 1
Trade name, active ingredient, and standard dosage of seed protectants tested two years or more on peanuts in Alabama 1944-1949.

Trade name	Active ingredient	Standard dosage per 100 lb. seed
"Arasan"	50% Tetramethyl thiuramdisulfide	3
"Ceresan, 2%"	2% Ethyl-mercury chloride	4
"Ceresan M"	7.7% Ethyl-mercury p-toluene sulfonanilide	1.5
"Sperton"	98% Tetrochloro para benzoquinone	3
"Sperton W"	48% Tetrachloro para benzoquinone plus wetting agent	3
"Phygon"	90%, 2,3-Dichloro-1, 4-Naphthoquinone	3
"Phygon W"	50%, 2,3-Dichloro-1, 4-Naphthoquinone plus wetting agent	3
"Yellow Cuprocide"	Yellow cuprous oxide containing 47% metallic copper	4
"Vitron D"	95% electrolytic cuprous oxide	16
"Dow 9B"	50% Zinc trichlorophenate	3
"Merc-O-Dust"	Composition indefinite; contains mercury compounds and formaldehyde	3
"Seedox"	50% 2, 4, 5-Trichlorophenyl acetate	3

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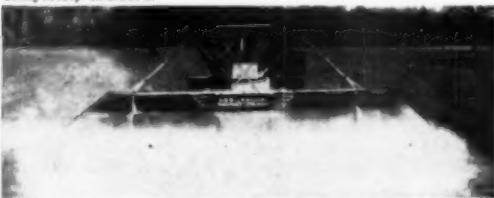
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Be in the lead with "The New Leader" Combination Commercial Fertilizer and Lime Spreader . . . equipped with the tapered and streamlined attachment hood shown above for maximum efficiency under all field conditions.

Notice that the attachment does not come straight out from the spreader but is scientifically designed to slant back and fit the exact curve of the spread coming off the twin distributor discs.

Heavy-duty rubber curtains on the attachment hood prevent material from blowing away, assuring an even and uniform spread. Also, notice that the conveyor coming through the endgate is completely enclosed.



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"The New Leader" Combination Commercial Fertilizer and Lime Spreader equipped with power take-off. Note uniformity of material flow along entire width of hood at 10 m.p.h. Width of spread on this New Jersey farm was about 24 1/2 feet. One round trip of an 80-rod field covers 1 1/2 acres. Choice of all-steel or wooden hopper. Sizes: 9', 11', 13' and 15'.

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New Motor-Driven Model — Uniformity of spread is not dependent on truck speed. Motor is mounted on catwalk and drives only the twin distributor discs at a constant speed, assuring full width of spread at all times and uniform distribution.

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TABLE 2
The effect of dosage upon the effectiveness of "Arasan,"
"Sperton" and "Dow 9B."

Treatment	Dosage per 100 lb seed	Increase in emergence due to treatment		
		1947	1948	Mean
Arasan	2	17.5	49.0	33.3
	3	16.6	55.3	35.9
	1	3.9	1.6	2.7
Dow 9B	2	6.4	33.0	19.7
	3	12.5	22.3	17.4
	1	7.0	27.0	17.0
Sperton	3	4.6	25.5	15.0
Sperton W	3 ¹			

¹ Equivalent to reducing the dosage of "Sperton" to 1.47 ounces per 100 pounds of seed. (Under unfavorable conditions for germination or with seed that has been injured in curing or storing, other investigators have also found this dosage to be relatively ineffective.)

effect of varying dosages of "Ceresan M" and of "Phygon" upon emergence of machine-shelled runner peanuts. As the dosage of "Ceresan M" increases, the emergence increases, reaching a peak at 1½ to 3 ounces per 100 pounds of seed. At 4½ ounces per 100 pounds of seed the emergence is less than that of untreated seed. Occasionally, "Ceresan M" is toxic to seed even at 3 ounces per 100 pounds of seed. "New Improved Ceresan" gives a similar effect. With "Phygon," the dosage is increased, the emergence increases, reaching a peak at about 3 ounces per 100 pounds of seed. As the dosage is increased above this point, the emergence drops slightly. Even at 8 ounces per 100 pounds of seed, however, the emergence is much better than that of untreated seed. "Sperton," "Sperton W," "Phygon W," "Arasan," and "Dow 9B" give results similar to "Phygon."

Processors often have to depend upon inefficient help. The protectants are applied with machines that become inaccurate with age or neglect. Under actual working conditions, the dosage applied varies considerably. For these reasons, the "Ceresan" treatments are not recommended in Alabama.

The nature of mercury toxicity has not been established. Seeds that have been overtreated with one of the "Ceresan" products start to germinate. The primary root may grow out for an inch or slightly more, but the

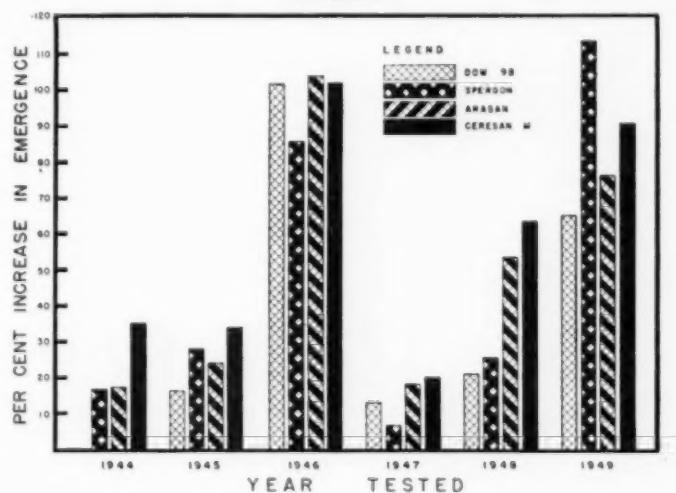
hypocotyl does not continue to develop. The hypocotyl continues to increase in diameter and the result is a deformed seedling.

Most of the organic seed protectants mentioned here have been tested at two or more dosage levels. Under the conditions of these tests, there was not a great deal of difference between dosages of 2, 3, or 4 ounces per 100 pounds of seed. The results of 2 years work with "Arasan," "Sperton," and "Dow 9B" are given in Table 2. The data are in agreement with those obtained from similar tests with one or more of the materials in other years. Even though dosages of 2 ounces per 100 pounds

have been found to be as efficient as 3 ounces per 100 pounds of seed for "Arasan" and "Dow 9B," larger doses usually are recommended because of the safety factor. If the dusting machine is set to treat at 3 ounces per 100 pounds of seed, a 33 percent variation is not harmful; however, the same variation would result in under-treatment for some seed if the machine were set to treat at the rate of 2 ounces per 100 pounds of seed. An attempt has been made to eliminate this danger in "Sperton W" by adjusting the concentration of the effective ingredient so that the dosage may be kept at 3 ounces per 100 pounds of seed and the cost reduced.

The regional peanut seed treatment tests have shown that the responses to a given seed protectant vary with the location. One of the best materials at one location may be one of the poorest at another location. The reason for this has not been established but probably is related to variations in soil and climate at the time of planting. The same kind of variation in efficiency of seed protectants can be demonstrated by comparing the same materials over a period of years at the same location. Figure 1 shows the relative value of "Dow 9B," "Sperton," "Arasan," and "Ceresan M" in the years 1945 to 1949. The data are shown as per-

FIGURE 1



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If there is any bag that *positively won't* permit dry particles to sift, this is it! Betner's new method of construction combines special liners with folding, gluing and heat-sealing in such a way that there is virtually "No Sift" for contents.

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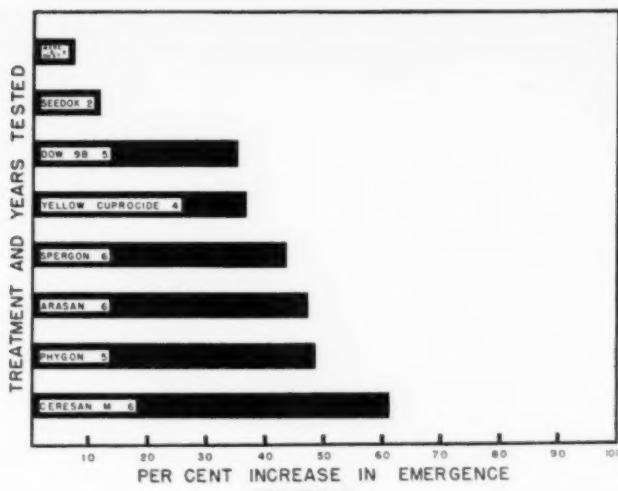


FIGURE II

tages increase in emergence over the untreated check. The data were calculated by the following formula:

$$\text{Percent increase in emergence} = \frac{\text{Emergence of treated plot} - \text{emergence of untreated plot}}{\text{Emergence of untreated plots}} \times 100$$

"Dow 9B" was not in the tests in 1944 and for that year only "Ceresan M," "Arasan," and "Sperton" are shown. In 1947, "Sperton" was the poorest of the four treatments. In 1949, "Sperton" was the best of the four, while in 1946, "Dow 9B" was as good as "Arasan" or "Ceresan M." On the other hand, in 1948, "Dow 9B" and "Sperton" were poor treatments in comparison to "Arasan" and "Ceresan M." Of the four materials, "Ceresan M" was the most consistent during the six-year period. "Arasan" was almost as consistent as "Ceresan M."

During this six-year period, the average percentage of increase in emergence for the four treatments varied from a low of 14.1 in 1947 to a high of 98.1 in 1946. Climatic conditions were unfavorable for germination in 1946 and in 1949. Under these unfavorable conditions, the protection offered by treatment is reflected by greater increases in stands. When climatic conditions are more favorable for germination, the need for pro-

tection is less and the increases in emergence are not so great.

During the six-year period

1944-1949, about 20 materials were tested on runner peanuts. Some of these were in the tests every year, while others were included in only a part of the period. This is due to the fact that some materials made such a poor showing the first year or two that they were discontinued, while some of the others were not available until recently.

Emergence of untreated seed in these tests has varied from less than 15 percent to more than 75 percent, indicating the important effect of external environmental factors and quality of seed on germination and efficiency of the treatment. This variation makes it difficult to compare emergence data from tests made in different years. Therefore, they have been summarized and presented as a bar graph in Figure 2. These data are for machine-shelled runner peanuts, except for 1944 when machine-shelled Spanish seeds were used. The data as shown are percentages of increase in emergence calculated as explained previously. In general, the treatments

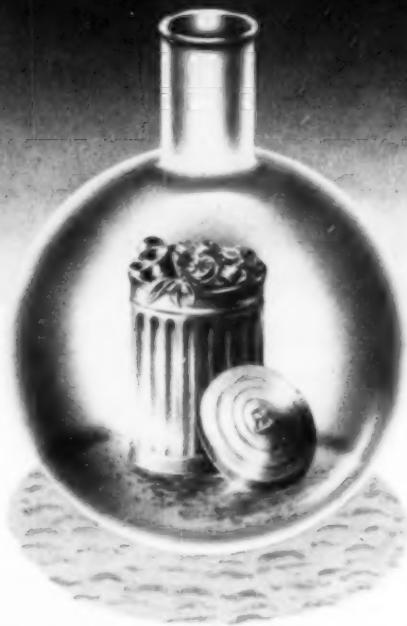
fall into three groups. There is a "poor group" that usually increased the emergence less than 15 percent. "Merc-O-Dust" and "Seedox" are in this group. The "good group" usually increased the emergence 30 to 50 percent. Included in this group are the copper compounds, the quinone compounds, and the organic sulfur compounds. The "excellent group" usually increased the emergence more than 50 percent. It is illustrated by "Ceresan M." At equivalent dosages, 2% "Ceresan" and "New Improved Ceresan" were equally good.

Value of Seed Protectants for Peanuts: Mechanical peanut shellers are prone to damage a high percentage of the seed. When the seeds are passed over shaking screens, most of those which are split, and the undersized seeds are removed. The remaining ones pass over a moving canvas belt and most of the seeds which are visibly damaged are removed by hand picking, but even so, the finished product contains many seeds with broken coats, small chipped spots, and minute cracks. When these seeds are planted, they are much more susceptible to attack by soil-borne fungi than undamaged seeds.

The seed also carries inoculum of saprophytic or weakly pathogenic fungi, such as species of *Fusarium*, *Sclerotium*, *Alternaria*, *Curvularia*, *Basisporium*, and *Rhizoctonia*, according to various investigators. By use of seed protectants, invasion by micro-organisms is retarded. The value of the treatment apparently is limited to its protective action during the time the seed is in the soil. No evidence has been presented to show that post-emergence damping-off of peanuts is controlled by seed treatment.

Although there have been reports that peanut seed may carry inoculum of *Cercospora personata*, *Sclerotium rolfsii*, and vascular wilt fungi, there is no evidence that seed-borne inoculum of these fungi play an important role in reduction of peanut stands. It is an established fact that seed treatment does not control any of these diseases satisfactorily.

(Turn to Page 91)



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The Insect Situation During April



This column, reviewing current insect control programs, is a regular feature of **AGRICULTURAL CHEMICALS**. Dr. Haeussler is in charge of Insect Pest Survey and Information, Agric. Research Adm., B. E. & P. Q., U.S.D.A. His observations are based on latest reports from collaborators in the department's country-wide pest surveys.

By G. J. Haeussler

Fruit Insects

LARVAE of the codling moth were pupating during the last half of April in several states, including Delaware, southern Indiana, and southern Illinois. Adults had not started to emerge in any of those areas by the end of the month, however. Egg masses of the red-banded leaf roller were reported from orchards in the Hudson River Valley of New York, in southern Indiana and in western Illinois, and adults of the small fruit moth were taken in the latter two areas toward the end of the month. Adults of the plum curculio were reported leaving hibernation quarters during the last half of April from Delaware and Maryland southward and in southern Indiana and southern Illinois. The larvae were entering peaches in the Carolinas and Georgia, but apparently this insect is no more abundant than during an average year. Fruit aphids were hatching generally in all areas, but there was no indication that they were any more abundant than usual.

Grasshoppers

DURING April some 13,870 acres of rangeland in Graham County Arizona were baited to control heavy populations of lubber grasshoppers. Preparations for combatting anticipated outbreaks of grasshoppers on range areas in northwestern Nevada, Wyoming and southern Oregon were made by Federal and cooperating agencies during April. In southern California economic species of grasshoppers developed rapidly in infested areas during the month. Active baiting programs were under way in Imperial, San Diego, and Santa Barbara counties, and by April

20, hatching had progressed into the San Joaquin and Sacramento Valleys of central California.

Cutworms

A N outbreak of the army cutworm in damaging numbers appeared in Carbon, Stillwater, Big Horn, and Yellowstone counties of Montana during March and early April. Infestations were heaviest in the latter two counties. Farmers began applying barn-sawdust-sodium fluor-silicate bait early in April and were prepared to apply chlordane or toxaphene sprays if needed when wheat had attained a stage of growth favorable to securing satisfactory results.

Vegetable Insects

SUB-NORMAL temperatures, with some frosts and cold winds, prevailed during most of April over a considerable part of the Southeastern States. These conditions caused much injury to beans, tomato, sweet corn, and other tender crops in many places and also tended to hold many species of insects at a low level.

Mexican bean beetle populations continued light in Florida and Georgia, but appeared to be on the increase toward the end of April. The first adults were observed on April 20 in the Charleston section of South Carolina. Light infestations of the bean leaf beetle and banded cucumber beetle occurred on beans in parts of South Carolina, Georgia, and Florida. The banded cucumber beetle was also reported infesting beans in Louisiana. A heavy infestation of the two-spotted spider mite occurred on beans in parts of Florida early in the month. Other pests reported attacking beans in the South during April in-

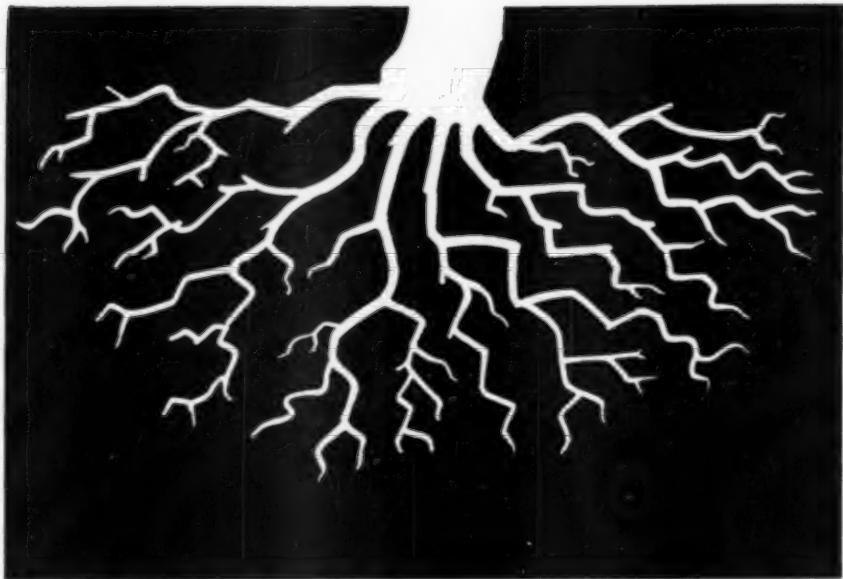
cluded the seed-corn maggot, potato leafhopper, serpentine leaf miner, lima bean pod borer, and thrips. In southern California the seed-corn maggot, the sugar-beet wireworm, and a species of whitefly caused some injury to beans during the month.

Populations of cabbage caterpillars and aphids on cole crops continued generally light to moderate during April throughout the South and in southern California. However, aphids caused some damage to occasional fields of young cabbage in Florida early in the month and toward the end of the month populations were sufficiently numerous to injure cabbage fields in Virginia, South Carolina, Tennessee, and California. Vegetable weevil populations decreased to a very low level on crucifers in Florida and other southern States. In Louisiana, light to moderate infestations of flea beetles occurred on mustard and turnip. Toward the end of April the striped flea beetle was abundant on turnips and radish in northwestern Tennessee, and the onion thrip was numerous on cabbage in California.

The pea aphid was abundant on alfalfa throughout most of the month in Delaware, and although populations were on the increase it was not reported infesting peas there. Moderate numbers of this pest were infesting peas in South Carolina during the last half of April. It was also abundant on peas in Manatee County, Florida, and was said to be present on all plantings of peas in northwestern Tennessee toward the end of the month. Light to moderate numbers of the pea aphid occurred in some alfalfa fields of the Blue Mountain district of Washington-Oregon, in the Yakima Valley of Washington, and in the Palouse district of Idaho-Washington.

The two-spotted spider mite continued destructively abundant during April on strawberry in Virginia and California and caused some damage to that crop in Delaware. It also occurred in lesser numbers on eggplant, sweet potato, and cucumber in Florida and on melons in California.

(Turn to Page 86)



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Technical Briefs

Nitrogen Boosts Yields

Stimulating the vigor of Montmorency cherry trees by broadcasting nitrogen fertilizer around each tree about two weeks before bloom, aided in overcoming the effects of cherry yellows infection, according to reports from the New York Agricultural Station at Geneva.

Although there is no known cure for the cherry yellows virus, an extra dose of nitrogen just before bloom, may prolong the productive capacity of the trees if treatment is begun before the trees are too severely injured by the virus, the report states.

The yield increase from nitrogen was due primarily to increased spur formation and percentage of fruit set. Both of these have been stimulated by the extra nitrogen in all the trees except possibly those most severely hit by the yellows. Terminal shoot growth is greater in trees receiving extra nitrogen, the longest shoots usually forming one or two spurs.

Earworm Control

A new method for control of corn earworm has been announced by the U. S. Department of Agriculture. R. A. Blanchard, Bureau of Entomology and Plant Quarantine, worked out the method and has field-tested it during three growing seasons in Texas, Mississippi, Missouri and Illinois. Spray applications of an emulsion containing DDT, mineral oil and water are used. For power sprayers, it takes 3 quarts of 2% percent DDT emulsifiable concentrate and 2½ gallons of white mineral oil diluted with water to make 25 gallons of this emulsion to spray one acre of sweet corn. Two or three applications are necessary. The first should be made the day when the first silks appear. Other applications follow at 2-day intervals. They cost from 3 to 5 dollars per acre, each. Experiments indicate that crops 85 percent or more

free of earworms, and all marketable, have resulted from such applications.

Tobacco Fumigants Tested

Use of a 50-50 mixture of acrylonitrile-carbon tetrachloride was found to be a satisfactory fumigant for cigarette-type tobaccos in tests with atmospheric and vacuum fumigation.

In laboratory tests at atmospheric pressure, it was as effective as hydrogen cyanide against cigarette beetle larvae, but less effective against tobacco moth larvae. It showed unusual penetration, yet it aired out rapidly. No injury to tobacco was noted. In commercial atmospheric chambers at summer temperatures a dosage of 20 ounces per 1,000 cubic feet, with an exposure of 72 hours, gave complete kill of cigarette beetle larvae to a depth of 9 inches in bales of Turkish tobacco. In hogsheads of flue-cured tobacco a dosage of 32 ounces with the same exposure gave 100 percent mortality of cigarette beetle larvae at a depth of 3 inches, 99 percent at 5 inches, 86 percent at 7 inches, and 72 percent at 9 inches.

In large warehouses of flue-cured tobacco in hogsheads a dosage of approximately 40 ounces per 1,000 cubic feet, with an exposure of 72 hours, gave excellent results against cigarette beetle larvae. In other warehouses fumigation with hydrogen cyanide at 16 ounces per 1,000 cubic feet was less effective against the tobacco moth.

In small vacuum chambers in the laboratory the minimum dosage of acrylonitrile-carbon tetrachloride to give complete kill of cigarette beetle larvae in bales of Turkish tobacco was 20 ounces per 1,000 cubic feet, with a 3-hour exposure and temperature of 73°-82°.

In vacuum fumigation in commercial chambers at temperatures above 60°F., a dosage of 48 ounces of acrylonitrile-carbon tetrachloride per 1,000 cubic feet, did not give complete mortality. However, at lower temper-

atures 64 ounces per 1,000 cubic feet, gave complete kill of cigarette beetle larvae to a depth of 9 inches in bales of Turkish tobacco.

No effect of acrylonitrile-carbon tetrachloride upon the aroma, taste, or appearance of flue-cured or Turkish tobacco was noted.

In a study of the effect of acrylonitrile-carbon tetrachloride on different materials, it was found that stainless steel is most satisfactory for use in vacuum or atmospheric chambers; copper showed little or no corrosion after 3 years; galvanized iron and tinned iron stand up for short periods; but plain iron is not satisfactory. Rubber tubing cannot be used.

— C. O. Bare and J. N. Tenhet in U.S.D.A. Bulletin E-794, February, 1950.

Chemical Weeding in Beets

Data gathered in 1948 on the use of salt for weeding beets showed that neither the stand nor the yield of canning beets was affected by the salt spray. The salt solution is made by dissolving 2 pounds of salt per gallon of water. For those who prefer to add nitrogen to the beet crop, 1.6 pounds of salt plus 1.2 pounds of sodium nitrate may be dissolved in 1 gallon of water. Either of these salt sprays applied to the row at 200 gallons per acre gave good weed control. This rate is calculated on the basis of land actually covered by the spray. Not all weeds common to beet fields are controlled by salt. Principal unwanted weeds in beet plantings that can be controlled with salt are Red-root (*Amaranthus retroflexus*), mustard (*Brassica arvensis*), Ragweed (*Ambrosia artemisiifolia*), and Smartweed (*Polygonum pensylvanicum*). Frequently, the seedling grasses of foxtail (*Setaria Spp.*) with grass (*Panicum capillare*), and barn yard grass (*Echinochloa crusgalli*) are killed by the salt spray. Two of the most common and most troublesome weeds of beets, lamb's-quarters (*Chenopodium album*) and purslane (*Portulaca oleracea*) are not controlled by these salt sprays. Beet seedlings will be killed if sprayed with

(Turn to Page 76)

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Incorporating many of the outstanding features of the larger, more expensive St. Regis packing machines, the new 325-PB is a rugged, dependable, centrifugal belt packer. In actual operation its output averages 18 to 24 tons per hour. Yet only one man operates this machine — a real saving in labor costs!

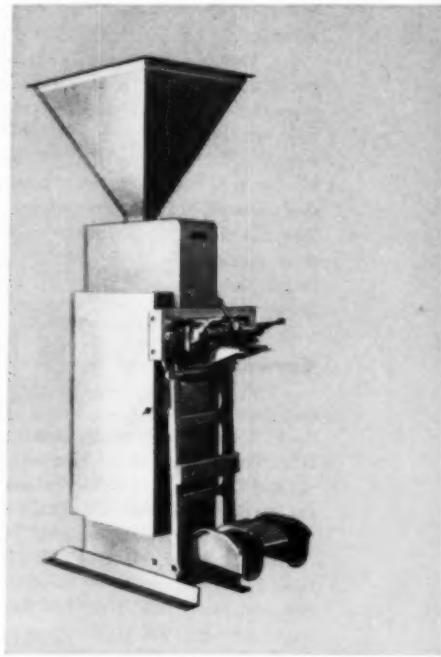
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Suppliers' Bulletins

Strainers For Spray Rigs

Spraying Systems Co., Bellwood, Ill., has announced two strainers for installation on spray rigs of any type or spraying capacity. One, the "3/4Q," will operate at pressures up to 600 psi . . . and should be installed in the line between the pump and spray boom, the company advises. The $\frac{3}{4}$ Q Line Strainer is made of brass with welded monel metal screen.

The other, designated as the "1-QSW" Suction Strainer, consists of a welded monel screen and screen retainer and it is designed for installation in a one-inch suction pipe. For complete information and prices write for Data Sheets 4658 and 4659 . . . Spraying Systems Co., 3230 Randolph St., Bellwood, Illinois.

Portable Mist-Blower

International Mutoscope Corp., Long Island City, N. Y., has announced a new portable mist blower, for use in livestock areas as well as inside barns. The machine uses air as the carrier for the mist which the makers say may be directed 35 or 40 feet high. Operated by one man, it features a five-gallon round bottom stainless steel tank, mechanical agitator, and interchangeable jet rings in the nozzle. Further information is available from the company, 4402 11th St., Long Island City 1, N. Y.

Superphosphate Carrier

Baughman Mfg. Co., Jerseyville, Illinois, offers to the fertilizer trade a new self-unloading transport trailer for hauling superphosphate without bagging. A belt drive conveyor in the bottom of the body unloads with minimum agitation, thus preventing the material from packing or crusting, the makers state.

The body is compartmentized so it can carry as many as six individual loads on one trip. A swinging boom directs material flow into bins, windows or portholes. The carrier is built of alloy steel, electrically welded. A waterproof roof may be installed

if desired. Details available from the company, 151 Shipman Road, Jerseyville, Ill.

Offers Spray Equipment

Independent Crop Dusting, Inc., Campbell, Calif., has issued a booklet describing its spray units for use in aerial application of pesticides. The equipment operates from a wind-driven propeller and distributes the liquid by a fast-revolving patented whirler. Write I-C-D Equipment Co., Campbell, California.

Offers Dust Data Booklet

A new, eight-page booklet describing the application and uses of "CPR Dust Base" has been published by U. S. Industrial Chemicals, Inc.,

producers of the dust base for insecticide manufacturers.

The wide range of effectiveness of CPR for truck crops is outlined in the booklet, which includes field-test data and other information concerning the outstanding features of CPR. Copies of the booklet may be obtained by writing U. S. Industrial Chemicals, Inc., 60 East 42nd Street, New York 17, N. Y.

Fertilizer Mfg. Booklet

Chemical Construction Corporation, New York, has published a bulletin describing the manufacture of nitrogenous fertilizer, with detailed diagrams to illustrate the process. The drawings trace the flow of raw materials through the various processes until the finished product is ready for delivery. The bulletin, "Nitrogenous Fertilizer Plants," is available from the company, 488 Madison Ave., New York 22, N. Y.



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able solvents, have many interesting, economical applications. The rotenone content on which the selling price is based is usually between 25% and 45%. Insecticides made with these versatile materials are completely active, convenient to use, economical, safe to humans and warm-blooded animals and leave no harmful residues.

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INDUSTRY NEWS

Douglass New S-D Head

Ralph B. Douglass, vice president and treasurer of the Smith-Douglass Co., Inc., was elected president of the company at a meeting of



RALPH B. DOUGLASS

the board of directors on May 11. He succeeds to the post made vacant by the death of president Oscar F. Smith, who had headed the fertilizer manufacturing concern since its inception.

Mr. Douglass, a resident of Norfolk since 1920, became associated with Mr. Smith in 1927 when the present company was formed as the successor to the Smith Reduction Company, an earlier fertilizer operation.

He came to Norfolk with the Eastern Cotton Oil Company and had been vice president of the company for several years when he joined with Smith in a fertilizer manufacturing business which today has plants throughout the east, and as far west as Albert Lea, Minn.

Prior to his arrival in Norfolk, Mr. Douglass had been with several firms engaged in the cotton seed oil and fertilizer business. A former chairman of the executive committee of the American Plant Food Council, Inc., and one of its incorporators, he now is a member of its board of directors.

Other officers of the Smith-

Douglass Co., Inc., are James A. Monroe and William B. Copeland, both vice presidents, and W. Farley Powers, secretary.

Fire at Am. Ag. Chem. Co.

The fire and explosion of the South Amboy, N. J. American Agricultural Chemical Co. plant May 20, was the result of burning elemental phosphorus, not fertilizer material, a spokesman for the company stated. The company said that production of agricultural chemical materials would not be affected by the blast which resulted in a ten-million-dollar loss to the city's shopping and residential districts, and the loss of 26 lives.

At press time, it had been impossible for company officials to estimate the damages to its own plant, but it was expected to be regarded as a total loss.

Arledge Heads V-C Sales

C. Cecil Arledge became vice president in charge of sales of Virginia-Carolina Chemical Corporation on June 1, it has been announced by



C. C. ARLEDGE

Joseph A. Howell, president of the firm.

Mr. Arledge comes to Richmond from Atlanta, Georgia, where he has been a sales executive of Armour Fertilizer Works for a number of years. In his new position, he has general supervision of the sales activities of the V-C corporation.

MEETINGS

Chemical Specialties Manufacturers' Association. Drake Hotel, Chicago, Ill., June 12, 13.

The National Fertilizer Association Greenbrier Hotel, White Sulphur Springs, W. Va., June 12-14.

Pacific Slope Branch, A.A.E.E. Hotel Casa del Rey, Santa Cruz, Calif., June 14, 15 & 16, 1950.

Pacific Division, APS. Salt Lake City, Utah, June 21-23.

North Central Division, APS. Michigan State College, East Lansing, Mich., June 22-24.

American Plant Food Council. The Homestead, Hot Springs, Va., June 23-30, July 1 & 2.

South Carolina Fertilizer Conference. Clemson College, Clemson, S. C., July 12 & 13.

National Shade Tree Conference. Syracuse, N. Y., Aug. 21-25.

National Agricultural Chemicals Association. Essex & Sussex Hotel, Spring Lake, N. J., September 6, 7 & 8.

California Fertilizer Association. Coronado Hotel, San Diego, Calif., November 2-4.

American Association of Economic Entomologists. Denver, Colorado, Dec. 18-21.

Proposes Liquidation

Liquidation of Brooklyn Chemical Works, Baltimore, Md. has been recommended to the U. S. District Court for Baltimore, after the court had appointed trustees to get the concern back into production. Frederick Arden, co-trustee, said that he had been unable to raise the necessary capital to put the company in operation again, and for this reason, along with other matters now under investigation by the district attorney, he proposed that the plant be put into the hands of receivers and be sold in settlements of debts. The company was a producer of copper sulfate and other chemicals.

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✓ **Reduced grinding costs:** Because of Celite's higher liquid absorption properties (more than twice its weight of water), you can grind up to 70% DDT mixtures. High concentrates of BHC and other low melting point poisons may also be ground with Celite.

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In addition to these savings, Celite 400, when used as the primary grinding aid, will impart greater kill power to the poison. Also, when used as the absorbing agent for liquid poisons, Celite 400 makes highly concentrated dry dusts at the lowest possible cost. For more information on the use of Celite 400, write Johns-Manville, Box 290, New York 16, N. Y.

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Bulk: Celite bulks much higher than most diluents

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Harvey A & S Sales Mgr.

Arkell & Smiths, paper bags manufacturers, have announced the appointment of George S. Harvey as their New England Sales Manager.



GEORGE S. HARVEY

He has represented A & S in New England since 1926, and is largely responsible for the successful promotion of paper bags for shipping Maine potatoes.

Mr. Harvey will continue to make his headquarters at the Statler Office Building in Boston. Working under Mr. Harvey, is Wallace H. Barrows who joined the Arkell & Smiths sales organization recently.

CSMA In Chicago Meeting

The 36th midyear meeting of the Chemical Specialties Manufacturers' Association (formerly NAIDM) was scheduled for June 12 and 13 at the Drake Hotel, Chicago. An insecticide symposium was to be held Monday afternoon, with T. Carter Parkinson, McCormick & Co., Baltimore, presiding. On the program were Dr. G. R. Ferguson, Geigy Co., Inc., New York; Dr. E. F. Knippling, USDA, Washington; Dr. Ralph B. Marsh, University of California, Berkeley; and John D. Conner, Gen. Counsel for C.S.M.A.

A joint session of the aerosol and insecticide divisions was planned for Tuesday morning, with a symposium on allethrin being presented. Dr. Alfred Weed, John Powell & Co., New York, was listed as moderator. Scheduled to appear on this program

were Drs. C. D. Fischer, Carbide & Carbon Chemicals Div., New York; J. B. Moore, McLaughlin Gormley King Co., Minneapolis; Donald F. Starr, S. B. Penick & Co., New York; Howard A. Jones, U. S. Industrial Chemicals, Inc., New York; R. A. Fulton and R. H. Nelson, USDA, Beltsville, Md.

New Committee Formed

A "Departmental Coordinating Committee" has been named by Secretary of Agriculture Charles F. Brannan to deal with the problem of insect and rodent-damaged grain, including methods of prevention and control. The committee provides a single group for considering questions on the subject, the USDA points out. Committee members are M. P. Jones, Extension Service; A. F. Nelson, Grain Branch of the Production and Marketing Adm.; and C. M. Packard, Bureau of Entomology and Plant Quarantine, chairman.

"Allethrin" Official Now

The suggested name of "allethrin" to designate the allyl homolog of cinerin I, or "synthetic pyrethrum," has been officially adopted by various agencies which are interested in the establishment of simple words to designate complex technical terms. The announcement, made on May 15, was issued by Dr. S. A. Rohwer, chairman of the Interdepartmental Committee on Pest Control.

Miss. Plant Operating

Approximately 4,000 tons of dust mixture and some 120,000 gallons of liquid emulsions for use by growers in the area, are expected to be produced this year by the new Coahoma Chemical Co. which opened recently in Clarksdale, Mississippi. The firm's products, which will be marketed under the trade name, "Red Panther," include agricultural insecticides, fungicides and dusts. Officers of the new company are: Kinchen O'Keefe, president; Wm. H. Graham, vice-president; "Buck" Mutler, secretary-treasurer.

Gabeler, Davison, Dies

William H. Gabeler, 58, manager of the Phosphate Rock Division of The Davison Chemical Corporation of Baltimore, Maryland, died



WILLIAM H. GABELER

April 29 in Bartow, Florida, where his office was located and where the company has extensive phosphate mining interests. He was widely known in the fertilizer industry.

A native of Lawrence, Massachusetts, Mr. Gabeler attended Andover Academy and was a 1915 graduate in engineering of Massachusetts Institute of Technology. He joined Davison in 1920 and was assigned to assist in the development of the phosphate rock properties of the company at Bartow, thus acquiring an early interest in what later became his life work.

He served as General Superintendent of the Davison Curtis Bay plant from 1936 to 1942 when he was made assistant vice president. In 1945 he assisted in the development of an expansion program in connection with the corporation's fertilizer plants. In August 1946, he was made manager of the new Phosphate Rock Division, which position he held until his death.

To New N. Y. Address

Chemical Construction Corp., New York, has moved its offices from the Empire State Building, to a new address, 488 Madison Ave. The new telephone number is MURRAY Hill 8-2370.

Belgian Ag. Man in U. S.

Making a six-week tour of American agricultural experiment stations, Emile Tilemans, Director of the Station of Phytopharmacy of the Belgian Ministry of Agriculture, Gembloux, Belgium, has been in the U. S. since May 8th under auspices of the E. C. A. Interviewed by Agricultural Chemicals in New York, Mr. Tilemans said that he hoped to learn more about the techniques used in American agricultural experiment stations, particularly in reference to herbicides. He reported that more than fifty percent of the pesticides used in Belgium, are made in the U. S. He also stated that most of the laboratory equipment in use at his station originated in the States.

The function of his station includes not only basic research, but it also performs work similar to that done by the Food and Drug Administration in the U. S. It tests all chemical products before they are allowed to be marketed, and each product is assigned a number which is put on all labels. Thus the 18 inspectors who operate in the country's nine provinces, send samples back to the station at Gembloux, and tests determine whether or not the material agrees with the initial test made before the product was placed on the market.

Mr. Tilemans was being escorted in New York by H. L. Woudhuysen, head of a New York firm of research chemists bearing his name. Mr. Woudhuysen was formerly associated with Mr. Tilemans in Belgium before coming to the U. S. some seven years ago.

A. A. C. Names Powell

American Agricultural Chemical Co., New York, has announced that C. M. Powell has been elected president of the firm to succeed L. H. Carter, retired. Mr. Powell was formerly vice-president of the company. Other officers named by A. A. C. include A. W. Cramer, elected senior vice-president; W. H. Hilderbrandt, secretary and comptroller, and H. Mayo, treasurer. Retiring as operating officers are G. H. Fick and A. B.

Arnold. Messrs. Carter and Fick will remain as members of the board of directors.

Orbis Chairman Dies

Charles J. A. Fitzsimmons, 71, chairman of the board of directors of Orbis Products Corp., New York, died May 2 in New York. Mr. Fitzsimmons founded the Orbis Corp. in 1918, following previous associations with Parke Davis & Co. and National Aniline Chemical and Dye Corp. He has served in a number of directorships and was a trustee of a bank in Brooklyn, N. Y., where he made his home.

T. M. Dues to Federal Chem.

Federal Chemical Co., fertilizer manufacturer, Louisville, Ky., has announced that Theo. M. Dues has been appointed Assistant General Sales Manager of the firm. Mr. Dues joined Federal in 1932, and has been Federal's Advertising Manager for nine years. In addition to his new duties, he will continue to direct the company's advertising.

N. Y. Issues Annual Report

The Sixty-Eighth Annual Report has been issued by the New York State Agricultural Experiment Station, Geneva, N. Y. The book contains brief reports of insect control experiments, tests with fungicides and weed killers, and the economic problems involved in spray programs. The report was made by Arthur J. Heinicke, Director of the Station, and published under the authority of Cornell University.

Gilman Opens New Office

Gilman Paper Co., New York, with plants in Gilman, Vermont and St. Marys, Georgia has announced the opening of a Western Sales Office in the Daily News Bldg., in Chicago. The office is under the management of Ernest A. Kendler, who has been with the Gilman organization for over 25 years.

Ranch Exposition Planned

The International Ranch Exposition is to be held October 6 through 15 at the International Amphitheatre in Chicago, it has been announced. The show is expected to draw an attendance of more than 300,000.

Exhibits of the chemical industry will include fungicides, pesticides, and fertilizers, it is stated.

NAC Plans Fall Meeting

Although the program had not been completed at press time, plans for the annual fall meeting of the National Agricultural Chemicals Association were getting under way, according to Lea S. Hitchner, Washington, D. C., executive secretary of the Association. The meeting will be held as usual, at the Essex and Sussex Hotel, Spring Lake, N. J., September 7, 8 and 9. The program is expected to include a review of the Food and Drug Administration Hearings, reports on new insecticides and fungicides, and Association committee reports. A full program will be published in a later issue of Agricultural Chemicals.

TECHNICAL BRIEFS

(Continued from Page 67)

these solutions before they have developed at least 3 to 5 true leaves. At other stages of growth beets may wilt for a day or two. It is important that the sprays be applied when the weeds are small in order to get a good kill of weeds. If the weeds are small, a pressure of 30 pounds gives good coverage, whereas better coverage on large weeds is obtained with 100 pounds pressure. Two nozzles, preferably of the fan-spray-pattern type, should be mounted on the boom in such a manner as to give complete coverage of the weeds within a single beet row. Spraying equipment should be thoroughly rinsed after using because the concentrated salt solutions corrode both metal and non-metal parts very rapidly.

—C. H. Dearborn in N. Y. State Agricultural Experiment Annual Report, 1949.

Pacific Slope Branch AAEE Meets at Santa Cruz

THE program of the Pacific Slope Branch of the American Association of Economic Entomologists, scheduled to be held June 13-16 at Santa Cruz, Calif., has been announced by the program chairman, Stanley F. Bailey, University of California, Davis. With the Casa del Rey Hotel as headquarters, the meeting was to begin with registration Tuesday evening, and the formal program under the chairmanship of Dr. H. M. Armitage, Sacramento was to begin Wednesday morning. Appearing on the advance program for this initial session were Dr. C. P. Clausen, U.S.D.A., Washington, D. C., president of the A.A.E.E.; Dr. Roy E. Campbell, Alhambra, Calif.; and Walter Carter, director of Oriental Fruit Fly Investigations, Honolulu, T. H.

Technical papers were slated for presentation Wednesday afternoon in a session scheduled to be under the chairmanship of Dr. Bailey. That evening a section on extension entomology was to be held under the chairmanship of J. N. Roney, University of California.

A report of the FDA residue tolerance hearings in Washington was to be given by Dr. Alvin J. Cox, Palo Alto, Calif., who had attended the sessions representing a number of west coast groups. Ed. H. Littooy was to be chairman of the Thursday morning session. A movie on Oriental Fruit Fly was to be shown at this meeting, and in addition, a half-dozen technical papers were to be presented.

Thursday afternoon's activities were to be presided over by Laurel G. Smith, with a paper reading session featuring the meeting. Nine papers were listed on the advance program. A cocktail hour was to be held at 6:30 Thursday evening, followed by the annual banquet and dance.

Mr. Littooy was to be chairman of the Friday morning session which included a motion picture on "Newest Developments in Machinery for Application of Insecticides," by I. G. Ross, Food Machinery & Chem-

ical Corp., John Bean Western Div., San Jose, Cal. A succeeding paper, prepared by E. R. de Ong, Kenneth C. Peer and L. W. Fancher, described a new generator for producing dry aerosols with organic insecticides. The remainder of the morning program and the entire afternoon session was to be devoted to technical papers.

Opens District Office

American Cyanamid Co. has established a new District Sales office to handle insecticide orders. According to the company announcement, all insecticide orders should be addressed to American Cyanamid Co., 48 W. 38th St., New York 8, N. Y.

Pacific Div. A. P. S. Meets

A two-day program was scheduled for the thirty-second annual meeting of the Pacific Division of the American Phytopathological Society, to be held at the University of Utah, Salt Lake City June 21-23.

Secretary George A. Zentmyer, University of California, stated early this month that the meeting would start with registration at 8:30 Wednesday morning, and that the first session would be under the chairmanship of J. P. Meiners, Twin Falls, Idaho. Some twelve papers were to be presented at this morning session.

George W. Cochran, Logan, Utah, was to be chairman of the Wednesday afternoon session which was to feature the presentation of fifteen additional papers. Paper presentations were to continue Thursday morning at a session with H. E. Morris, Bozeman, Montana, in charge. That afternoon was to feature a business session, and a symposium demonstration session with L. C. Cochran in charge. This part of the program was to see demonstrations and exhibits of new techniques, new or special phases of investigations, etc. The Phytopathologists' dinner was to be held Thursday evening.

An all day field trip in charge of Dr. B. L. Richards, Utah State College, was scheduled for Friday. This trip was to include a visit to

truck crop areas near Salt Lake City, a visit to the American Smelting and Refining Co. laboratories, and to the Utah Agricultural Experiment Station. Officers of the division are William C. Snyder, University of California, Berkeley, president; Earle C. Blodgett, State College of Washington Experiment Station, vice-pres; George A. Zentmyer, Riverside, Calif., secretary-treasurer; and L. C. Cochran, U.S.D.A., Riverside, Calif., councilor.

Divisional APS Meetings

The North Central Division of the American Phytopathological Society was scheduled to hold its summer meeting at Michigan State College, East Lansing, June 22-24, according to announcement by Dr. M. F. Kernkamp, Division secretary. In charge of the program is Dr. Donald Cation, who stated that the conference would discuss chemical weed control as well as control of various plant diseases. Speakers appearing on the advance program included B. H. Grigsby, Dr. Cation, Axel Anderson, Ray Nelson, F. C. Strong, Donald DeZeeuw, J. H. Muncie, and H. W. Bockstahler. A business session was to be in charge of Ralph M. Caldwell, Division president.

These speakers were to appear on the first day's program, whereas the activity of June 23, the second day, was to begin with a picnic breakfast, and an informal dinner in the evening. The final day's program included alternate trips to visit muck crops, potato experiments, turf experiments, and other trips in the area.

Brunn Joins Atlas Powder

Lynn K. Brunn has joined the technical sales staff of the Industrial Chemicals Division of Atlas Powder Co., Wilmington, Del., the company has announced. He will be a consultant on the line of emulsifiers for the agricultural chemicals field, and will contact Federal and State experiment stations on formulations. Mr. Brunn was recently associated with the agricultural chemicals division of Sherwin-Williams Co.



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Fertilizer Controls Off

Nitrogenous fertilizers have been removed from export controls by the U. S. Department of Commerce, which means that this material may now be shipped in any quantity to any country without an export license.

Appointed Chase Bag Mgr.

The appointment of John A. Sutherlin as Sales Manager of Chase Bag Company's New Orleans Branch has been announced by J. H. Counce, Manager at New Orleans. Mr. Sutherlin became a member of the New Orleans territory's sales force immediately following his tour of duty as an Army Air Force pilot during World War II. His new assignment will include eight states in the South and Southwest with New Orleans as his headquarters.

Dow Offers Lindane

Dow Chemical Company, Midland, Mich., has announced that it will offer a new, 20% emulsifiable formulation of lindane during the 1950 season. Lindane has been approved by the United States Department of Agriculture for use in dairy barns.

Joins Alrose Chemical

Ralph E. Kaye, Jr., has joined the Alrose Chemical Company of Providence, R. I., as mid-west sales representative, with headquarters at the new Alrose-Chicago Office, 629 West Washington Street. Mr. Kaye was formerly associated with Atlas Powder Company.

New Chem. Dictionary

A new edition of the *World Chemical Directory* has been announced by the Atlas Publishing Co., 425 W. 25th St., New York 1, NY. The directory contains 700 pages, listing over 18,000 firms located in every important country in the world, which are exporters, importers and manufacturers of chemicals, drugs, plastics and oils. The listings appear in English, French and Spanish. Price is \$10, postpaid, the publishers state.

(Continued from Page 37)

TABLE 6

Weighted Average Plant Nutrient Content of Commercial Mixtures Consumed During Year Ended June 30, 1949

State & Region	Nitrogen	Available Phosphoric Oxide	Potash	Total	1947-48 Comparative Total
	Percent	Percent	Percent	Percent	Percent
Maine	5.92	10.22	12.56	28.70	28.25
New Hampshire	4.27	11.80	11.08	27.15	26.68
Vermont	5.57	15.32	12.33	29.72	28.39
Massachusetts	5.02	11.35	8.80	25.20	22.95
Rhode Island	6.00	10.22	9.44	24.66	24.51
Connecticut	5.49	8.17	8.30	21.95	21.73
New England	5.44	10.42	11.16	27.02	26.52
New York	4.81	11.13	7.77	23.71	23.80
New Jersey	4.77	10.32	9.13	24.72	24.15
Pennsylvania	3.73	12.41	7.60	23.74	22.71
Delaware	3.31	11.30	8.40	23.01	23.05
District of Columbia	5.60	10.18	6.02	21.70	21.53
Maryland	3.56	11.51	7.68	22.74	22.62
West Virginia	5.39	12.36	6.80	22.55	22.64
Middle Atlantic	4.16	11.81	7.91	23.45	23.24
Virginia	3.24	10.96	7.26	21.45	20.92
North Carolina	3.65	9.90	7.17	20.72	20.03
South Carolina	4.00	9.93	6.83	20.75	20.86
Georgia	4.04	8.57	6.35	18.96	18.92
Florida	4.48	7.55	6.72	18.75	19.11
South Atlantic	3.87	9.38	6.87	20.12	19.34
Ohio	2.48	12.60	8.46	23.54	22.81
Indiana	2.35	12.54	10.65	25.54	23.66
Illinois	2.79	12.35	11.46	26.57	24.88
Michigan	2.32	13.24	9.70	26.26	24.22
Wisconsin	2.27	12.90	12.45	27.62	26.31
East North Central	2.43	12.69	10.15	25.27	24.02
Minnesota	2.88	17.87	12.50	33.05	27.91
Iowa	3.47	14.30	7.32	25.09	22.79
Missouri	3.18	12.49	7.26	22.35	21.50
North Dakota	2.71	19.04	10.45	32.22	34.10
South Dakota	4.12	15.73	1.47	21.82	21.29
Nebraska	6.32	18.73	1.76	26.91	25.10
Kansas	3.96	13.12	4.52	21.60	20.76
West North Central	3.50	14.37	8.09	25.75	23.59
Kentucky	3.51	10.98	6.57	21.06	20.37
Tennessee	3.59	10.57	6.07	20.03	19.75
Alabama	4.70	9.16	6.05	19.91	19.50
Mississippi	5.55	9.74	5.86	21.13	20.71
East South Central	4.43	9.33	6.12	20.55	19.93
Arkansas	4.81	9.90	9.34	24.06	23.21
Louisiana	5.19	10.89	8.80	21.48	20.97
Oklahoma	4.23	11.59	4.46	20.28	20.39
Texas	6.58	11.00	4.73	20.28	20.38
West South Central	4.76	10.57	6.19	21.62	21.21
Montana	10.09	20.23	1.28	31.60	34.14
Idaho	10.25	14.23	1.82	26.27	28.22
Wyoming	9.34	22.29	2.81	34.44	30.45
Colorado	8.07	20.62	5.90	34.59	35.46
New Mexico	8.23	12.55	4.89	25.47	22.91
Arizona	10.62	14.51	1.02	26.15	27.11
Utah	9.35	16.21	2.14	27.70	30.32
Nevada	8.55	12.97	3.24	24.96	27.51
Mountain	9.55	16.89	2.96	29.40	29.75
Washington	6.15	10.22	8.27	26.32	25.00
Oregon	6.39	13.09	9.75	29.73	26.94
California	9.04	9.75	4.89	24.58	24.21
Pacific	9.24	10.15	5.71	25.15	24.54
Hawaii	11.29	7.98	16.45	35.72	36.02
Puerto Rico	10.12	6.51	9.22	26.65	24.82
Territories	10.29	6.56	10.26	27.15	26.52
Continental U. S.	3.37	10.87	7.75	22.47	21.30
1948-49 U. S. Average	3.99	10.78	7.78	22.55	21.90
1947-48 U. S. Average	4.04	10.71	7.15		21.99

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New Plant for High-Analysis Fertilizer in Illinois

WHITESIDE Service Company, Morrison, Ill., is erecting a new fertilizer plant which will handle straight bulk, high-analysis fertilizers, including trace materials. Lyle Everist, manager of the plant, states that his firm sells only high analysis fertilizer in straight materials such as 45% to 62% available phosphate, 60% potash and 33% nitrogen. "We do not sell any of the conventional mixed fertilizers such as 2-12-6, 0-12-12, and the like," he says.

Mr. Everist reports that the company requires a soil test of the farm on which fertilizer is to be used, before the material is sold. This policy is the outgrowth of nine years of experience, he says. "In observing the results (from use of fertilizer) we found that some farmers got excellent returns; others very little, and some experienced a decrease in yield," Mr. Everist recalls. "To determine what analysis a farmer should use, we had

to use the trial and error method, or find out what his neighbor was using. It was impossible to give the farmer an intelligent answer about what analysis fertilizer he should use."

Thus it was, that five years ago, through the cooperation of the Whiteside County Farm Bureau, a soils testing laboratory was set up to give the farmer an honest diagnosis of his soil's needs, and to provide a yardstick for determining what fertilizer to use. Since the laboratory is an independent entity, with nothing to sell the grower, the results of soil tests are regarded as an actual appraisal of fertilizer needs, and the Whiteside company sells mixed fertilizer on that basis.

"After five years of this type of selling, it is paying big dividends to the farmer and to our company," according to Mr. Everist. During that time, he says, some 1,500 farms have been tested in his county. Of these,

63% are in need of phosphate, and 60% are in need of potash. Most of the lime requirements for growing clover, are already in the soil.

This manufacturer has complete knowledge of the amounts of nutrients which are removed from the soil by given crops. "The corn in our county, per hundred bushels, takes out 150 pounds of nitrogen, 17 pounds of phosphate, and 75 pounds of potash," he states. "Where the soil is deficient we apply at least 90 units of available phosphate and 120 units of potash per acre ahead of a clover crop. Four tons of clover plowed under gives about 150 units of nitrogen plus tilth, so for our corn we use 150-90-120. The results that we are getting in increased yields of clover and corn are almost unbelievable. It doesn't take long to write the mortgage off of a farm if you keep your soil fertility in balance—and a 2-12-6 fertilizer will not balance out any land that I have seen!"

"Last year the Service Company started using trace minerals. We



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sent soil samples from twelve different farms away to be analyzed by a spectrum. This indicated that the patterns of deficiency were almost uniform since the soil contained very little iron, no iodine, very little zinc or manganese, and only a fair amount of copper and boron. We are taking these combined elements, with cobalt added, in the concentrated form and applying them in test strips with the cooperation of the Central Farmers

Fertilizer Company, and the International Harvester Company which has been analyzing the nutritional value of these crops for us. To date there is every indication, from our results, that the land needs to maintain a balance of all these materials for maximum yields and health.

"The demand from the farmers in this territory for our type of fertilizer program, is causing us to erect our new plant. We will con-

tinue to sell fertilizers based on the soils laboratory test," concludes Mr. Everist.

Offer Screw Worm Control

California Spray Chemical Corp., Richmond, Calif., has introduced a new lindane product, "Ortho 1038" for control of screw worm. According to tests made in the southwest, after the material is applied, the worms come to the surface of the animal's skin, through cuts and wounds which they infest, thus leaving the sore clean and easily healed. The material has been tested on all types of livestock including horses, dogs and hogs with satisfactory results, the report states. It is used for the screw worm in dehorning, docking and shear cut cases. "Ortho 1038" is available for experimental commercial use only, during 1950. Descriptive literature is available from the Company's offices at Uvalde, Texas.

Toxaphene Booklet Out

A new publication, "More Profit Per Acre," on the use of toxaphene dusts or sprays for cotton insect control, has just been released by Hercules Powder Company.

The booklet summarizes recommendations for applying toxaphene against common insects, stressing good farming practice such as plowing under cotton stalks and destruction of the boll weevil's hibernating quarters.

Information about the proper use of toxaphene insecticides, recommended dosages, and methods of applying both dusts and sprays by ground or air equipment are included in the booklet, which is available from Hercules Powder Company, 970 Market St., Wilmington, Del.

Pennsalt Names Hurley

The appointment of Paul C. Hurley, Jr., as Manager of Pennsylvania Salt Manufacturing Company's newly-created Sales Promotion Department has been announced. As head of the new department, Mr. Hurley will be in charge of advertising, promotion research, and the Company's salesmen-training program. He joined Pennsalt in 1943.

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Bemis Reviews 50 Years

Bemis Bag Co. has issued recently a booklet, "Fifty Years in the life of a Community," telling the story in text and photographs, of the half-century history of Bemis, Tennessee. The book's story begins in 1900 and continues through to the present. Photographs show the Bemis mill, center of the town's activity, and other nostalgic shots of the community brass band, company employee groups, pictures of parades and other events, and a history of the company's growth over the years.

NFA Pasture Tour in July

An all-week pasture tour sponsored by the Plant Research Committee of the National Fertilizer Association is scheduled to begin on July 9 at Providence, R. I. Plans for the tour include visits to pastures in all six New England states. From Providence, the group will visit the R. I. Agricultural Experiment Station at Kingston on Monday; Tuesday, to

Storrs, Conn., to inspect pasture fertility plots; Wednesday, visits to a number of farms in Vermont; Thursday, to the experimental plots at Durham, N. H.; and Friday, at farms in Maine, with the tour ending officially at Portland Me.

A group of nearly 50 persons is expected to take part in the tour. The industry committee is composed of S. D. Gray, Northeast manager of the American Potash Institute; and Robert H. Engle, NFA staff member. The green pasture committee consists of H. G. Albritton, R. I.; J. S. Owens, Conn.; R. W. Donaldson, Mass.; R. B. Littlefield, N. H.; and R. F. Talbot, Maine.

HEARINGS

(Continued from Page 57)

cide." Dr. Albert Hartzell, Boyce Thompson Institute, covered bioassay of "Metacide" residues, giving a de-

tailed description of manner of conducting bioassay experimental work.

Dr. Robert T. Hall, Hercules Powder Company, confined his testimony to a description of method used and results obtained in making determination of residues of toxaphene on various fruits and vegetables.

Eugene P. Ordas, Velsicol Corporation, stated that although one colorimetric method for determining chlordane residues has been published there is no reliable specific method. In his discussion of the chemical and physical properties of heptachlor, he said that the chemical and bioassay methods of residue determination for chlordane are also applicable for heptachlor.

J. Everett Bussart, another witness for Velsicol Corporation, covered the use of chlordane for control of insect pests on agricultural crops. Heptachlor has been found to possess especially high insecticidal activity against a wide variety of insects.

Dr. A. A. Nikitin, Tennessee

(Continued from Page 27)

Carloads of toxaphene or parathion or DDT or chlordane in warehouses hundreds of miles from the scene of infestation, can do no good either for the manufacturer nor for the desperate grower who has put off too long ordering the material he should have known all along that he would need.

Insect infestations apparently come suddenly . . . that is, the grower may think so, since yesterday there were no bugs, and today millions of them may be eating his crops by the ton. But actually, with the months of warning of unusually heavy insect populations in 1950, no infestation is a sudden thing. It is the natural result of having so many insects surviving the winter!

From what we've seen of industry's heavy production for this season, no one will be able to say that it fell down on the job. Manufacturers have been working day and night to produce enough toxicants for the expected need. If estimates are correct about a two billion dollar loss this year, it won't be because of industry's lack of effort.

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Corporation, discussed the use of copper fungicides on vegetables and fruits. He also discussed the use of zinc sprays on fruits and vegetables. The next witness who discussed copper, was Dr. James D. Wilson, who reviewed the historical development of copper fungicides and their use on fruits and vegetables.

Dr. H. W. Dye, Niagara Chemical Division, Food Machinery and Chemical Corporation, discussed the use of sulfur as a fungicide and insecticide. Further testimony relating to the various forms of sulfur used for insecticidal and fungicidal purposes, and a brief description of the manner of producing each of these forms, was given by Roscoe H. Carter.

A. Albert Danish and James M. Bann, of Julius Hyman Company, discussed respectively, the chemistry and residues of chlordane, aldrin and dieldrin, and the rate of insecticide residue loss from plants treated with chlordane, aldrin and dieldrin as compared with certain other insecticides.

Dow Chemical Company's witnesses, led by Dr. Oscar H. Hamner, who discussed the use of dinitro compounds as dormant sprays and for summer mite control, covered the use of 2,4-D and certain DN materials as herbicides, plant growth regulators, fruit thinning materials, the use of soil fumigants, and analytical methods of residue determination for these compounds.

Robert B. Arnold, Virginia-Carolina Chemical Corp., discussed the general chemical and physical properties of nicotine insecticides and residues resulting from their use as fumigants or smoke aerosols, from sprays and from dust.

Clyde W. McBeth, Shell Oil Company, discussed the use of soil fumigants and manner of applying them to the soil. Although he had no information relating to residues on fruit or vegetables grown on land treated with soil fumigants, he stated he did not see how there could be such residues.

Frederick Rieders, a witness

for Sharples Chemical Company, discussed the development of an analytical method for determination of residues of "Endothal," a defoliant-herbicide, and Dr. Nathaniel Tischler described the chemistry of "Endothal" and its use. He also discussed the experimental work being conducted on "M-294" and its use as a seed treatment and foliage spray. It has not yet been sold to growers as a fungicide.

Dr. John A. Riddick and Dr. James G. Sanders, of Commercial Solvents Corporation, discussed the chemistry and method of analysis of "Dilan" and the entomology of "CS-645A," "CS-674A" and "Dilan."

Dr. Harry F. Dietz was the first of seven witnesses testifying on behalf of E. I. du Pont de Nemours & Co. His testimony related to the use of methoxychlor on fruits and vegetables. Succeeding witnesses discussed characteristics and activity of methoxychlor; physical and chemical characteristics of "EPN"; develop-

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ment of ferbam, ziram, thiram, zincb, and nabam as fungicides; background of development of "Parzate" and "Parzate Liquid"; chemical and physical aspects of the dimethyl dithiocarbamates and ethylene bis dithiocarbamates; and analytical methods for determining residues of methoxy-chlor, "EPN," and the dithiocarbamates.

Dr. Frank B. Maughan, Dr. Charles T. Simpson and Dr. Edward L. Stanley, appearing on behalf of Rohm & Haas Company, presented testimony relating to the chemistry and use of "Karathane," (originally named "Arathane,") "Dithane" and "Rhothane."

Dr. T. C. Allen, appearing for John Powell & Company, reviewed the historical background and use of sabadilla.

Dr. C. O. Persing, of Stauffer Chemical Company, first described research work in development of acaricides and discussed the physical and chemical properties of "R-242," later presenting testimony about the use of xanthates as herbicides and defoliants.

Dr. T. W. Reed, California Spray-Chemical Corp., discussed the development of BHC and lindane. After describing chemical and physical characteristics of BHC and its isomers, he outlined methods of residue analysis, giving details of experimental work relating to off-flavor from the use of these insecticides. His testimony also covered the chemistry and use of phenyl mercury acetate fungicides and the development of "SR-406," which has been given the trade name of "Orthocide 406."

Robert W. Towne, Monsanto Chemical Company, discussed the composition of HETP and TEPP and described experimental work relating to chemical proof that the latter is readily hydrolyzed by water to harmless substances within a relatively short time.

Dr. Sylvan Cohn, Gallowhur Chemical Corp., discussed the use of phenyl mercury compounds as fungicides and enumerated the products which have been developed.

Dr. Frank J. Sowa, president

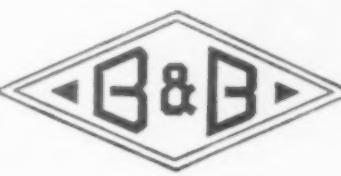
of Sowa Products, Inc., discussed the development of phenyl mercury compounds.

Dr. A. E. Griffiths, Socony-Vacuum Oil Company, reviewed the historical development of the use of oil as an insecticide and discussed the use of petroleum spray oils for the control of insects at the present time.

Russell B. Stoddard, U. S. Industrial Chemical Company, discussed three synergists, piperonyl cyclonene, piperonyl butoxide and

"compound No. 469," for the control of a variety of insects when used in combination with pyrethrum, rotenone, or both, and to a limited extent ryania.

Dr. Joseph B. Moore, McLaughlin, Gormley King Company, discussed the uses of pyrethrum, selocide and allethrin. Dr. Albert A. Schreiber, of the same company, discussed "Octacide 264," produced mainly as a synergist for pyrethrum or allethrin.



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Jarnagin to Attack Post

Attapulgus Clay Company, Philadelphia, has announced the assignment of William McP. Jarnagin to sales and technical service activi-



Wm. McP. Jarnagin

ties. Mr. Jarnagin is a graduate of the University of Tennessee at Knoxville, where he received his B.S. in Chemical Engineering in 1945. He

joined Attapulgus immediately after graduation, spending several years in the company's Research and Development division, followed by technical sales activities. Mr. Jarnagin will work out of the Philadelphia office succeeding L. M. Mank, who has been assigned to other duties.

S. C. Fertilizer Conference

July 12 and 13 are the dates set for the South Carolina Fertilizer Conference to be held at Clemson College. According to Dr. B. D. Cloaninger, head of the department of Fertilizer Inspection and Analysis at Clemson, all members of the fertilizer industry, including manufacturers, dealers and salesmen are invited to attend.

Handling Fertilizer Acid

Equipment and procedures for handling 75 per cent phosphoric acid in tank car quantities are described in a pamphlet available from Monsanto Chemical Company.

In addition to specifications for tanks, pumps and pipes, the text includes step-by-step explanations of several methods of unloading phosphoric acid cars, from spotting to preparing car for return. Copies are available from the company, 1766 S. Second St., St. Louis 4, Mo.

Offers Insecticide Data

Hercules Powder Co. has issued a bulletin on grasshopper control for 1950. The folder also discusses control of cotton insect pests and presents reports on the use of toxaphene in a number of insecticidal applications. Write for "Toxaphene News Digest," Hercules Powder Co., 970 Market St., Wilmington, Del.

INSECT SITUATION

(Continued from Page 65)

The serpentine leaf miner occurred during the month in light to heavy populations on potato, tomato, cucumber, and squash in Florida, and



RENTOX PEST-TESTED

WHY NOT PROTECT FOOD

CROPS IN STORAGE FROM RATS AND MICE

as you protect them from insects and diseases in the field?

RODENT CONTROL AND CROP PRODUCTION

Millions of dollars worth of insecticides and fungicides are used each year to produce our nation's farm crops. But little or nothing is done to protect them from the 150,000,000 rats and untold number of mice that attack these crops in storage. \$400,000,000 is a big price to pay for this damage. Rats eat or spoil half this amount yearly in cereals and cereal products alone.

When crops are protected in the field, only half the job is done. It's just as important for the farmer to protect his crops in storage as it is to protect them in the field.

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Tested under an experimental permit from USDA for the past four months, RAX powder (new rodenticide containing WARF Compound 42) is giving results that indicate easy, economical and safe control of rats and mice on the farm. While RAX is not permitted to be sold indiscriminately, we urge that manufacturers and distributors of agricultural chemicals investigate this new potential market. RAX powder is offered experimentally to interested companies for testing as a rodenticide on an experimental basis to be repacked under their own label. It is not approved by USDA for resale to consumers at present but you, as manufacturers of agricultural chemicals, should be ready to offer such a rodenticide when approval is obtained.



AGRICULTURAL CHEMICALS

was also reported infesting a wide range of vegetables in South Carolina and California.

Flea beetles were abundant toward the end of the month on potato in Florida, and occurred to a lesser extent on that crop and on tomato in other South Atlantic States.

Light to moderate infestations of onion thrips occurred on onions in many areas, including Virginia, South Carolina, Tennessee, Louisiana, California and Washington. This pest seemed to be on the increase in California. It was also reported infesting shallots in Louisiana.

Aphids have continued to infest tobacco plant beds in parts of Florida, Georgia, and South Carolina. Some small-scale outbreaks have occurred on shade-grown tobacco in Florida and also on flue-cured tobacco. Other pests reported attacking tobacco during April include the tobacco budworm in Florida, mole cricket in Florida and Georgia, cutworms in Florida and South Carolina, and green June beetle larvae and midge larvae in North Carolina. ★★

FERTILIZER PROGRESS

(Continued from Page 29)

it deserves rich credit, would have been impossible without research. I refer especially to the work of State and Federal agencies in showing what fertilizers were needed and where, when, and how to apply them; to the work of government and industry laboratories on the chemical and mechanical properties of fertilizer materials and mixtures; to the work of plant nutritionists, soil scientists, agronomists and many other groups that has contributed so greatly to our knowledge of scientific agriculture.

During World War II the fertilizer industry in a very large measure made possible the job done by the United States in feeding its own citizens, its armies, and a large part of the outside world. Without chemical fertilizers the job could not have been done.

What of the future? We may look forward, I think, to fertilizers adapted even more accurately to the

particular crop-soil situation; to mixtures more free-flowing through the increasing use of granulation, improved conditioning technics and moisture resistant bags; to wider use of such materials as ammonia and phosphoric acid in irrigation water and for direct application to the soil; to new processes and products; to increased use of minor elements, to name only a few of the many things which indicate progress. The industry will move forward if it keeps tuned

to the needs of agriculture and the advances of science.

COLLOIDAL SUSPENSIONS

(Continued from Page 45)

significant damage.

In New Zealand a voluntary Certification Scheme (sponsored by the Plant Diseases Division of the Scientific & Industrial Research Department) operates for spray-chemicals. This scheme was introduced in 1936, by Dr. G. H. Cunningham,⁶



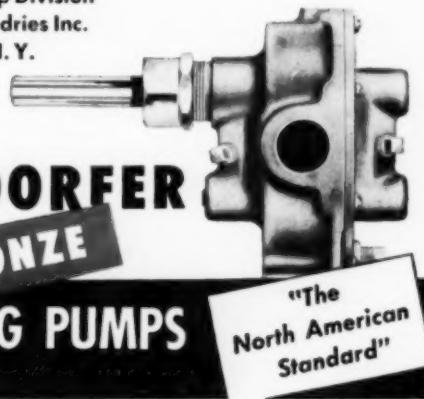
Not if you're prepared for their deadly, overnight onslaughts! The grasshopper and the corn borer can be controlled by timely spraying.

But Oberdorfer Spraying Pumps will not be available fast enough after these insects have struck. Stock up now so your customers can protect their crops when infestation starts.

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because in the words of the originator:—

"Our work of improvement in methods of combating bacterial, fungous and insect diseases and pests of plants has shown the necessity for assessing the value of the many sprays, dusts, fumigants, etc.—collectively termed therapeuticants—placed on the New Zealand market. Tests carried out during the past years have demonstrated that of these, quite half were ineffectual for the purpose for which they were sold."

Colloidal sulphur is the only elemental sulphur preparation approved by the Plant Diseases Division and placed on the Certification lists which are circulated regularly among buyers. Less finely divided products such as micronized sulphur, flotation sulphur (paste and powders) have not been approved for Certification because these preparations are not regarded as efficacious as colloidal sulphur.

Most New Zealand fruit-growers use tractor drawn pressure

spraying outfits, a smaller number used stationary plants with reticulated piping. There are a few speed sprayers, but at this writing concentrate or semi-concentrate sprayers have not been used commercially. It is expected colloidal dispersions will be eminently suitable for the new method of mist spraying, which will probably be introduced to New Zealand growers in the near future.

Processes Used

There are many references in the scientific and patent literature concerning methods of making colloidal suspensions and dispersible sulphur products. Some chemical methods are based on evaporation of ammonium polysulphide,¹⁷ reaction of hydrogen sulphide and sulphur dioxide,²² reacting ammonium polysulphide with an aldehyde,²⁴ and reaction of hydrofluosilicic acid with an alkaline polysulphide.²⁰ Typical of mechanical methods are grinding sulphur with quartz and flint pebbles,¹⁸ and emulsifying molten sulphur with subsequent chilling of the emulsion,²³ and comminution on high speed colloid mills.¹⁹ Dispersible products have been prepared by melting sulphur with a water soluble carbohydrate and wetting agent, to form a solid solution.²¹ In nearly every case stability of dispersions is conferred by use of suitable wetting and dispersion agents.

While some so-called colloidal suspensions of sulphur may meet the most exacting requirements relating to particle size, suspending, and adhesion on plant surfaces with consequent fungicidal efficiency, many methods developed hitherto have not been a success commercially for reasons such as high production costs, instability of the product, or unsatisfactory particle size reduction or distribution. Some products have been marred by the inclusion of a substantial proportion of grossly oversize particles.

In 1945 Tisdale¹⁴ recorded that much effort has been spent without success in attempting to produce truly colloidal sulphur for agricultural use.

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With DILUEX you can adopt a simple procedure that will regulate package volume to fit your container. Besides obtaining a uniform package appearance, your product will be greatly improved in

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In 1924 de Ong¹⁰ published an account of the preparation of colloidal sulphur, including the precipitation of sulphur from lime-sulphur solution by acidulation.

In a recent publication de Ong¹¹ states Colloidal Sulphur "is considered the most toxic of any form of sulphur, but because of its instability, cost and marketing difficulties at satisfactory concentration, it has not come into general use." These contentions are not applicable to Colloidal Sulphur pastes prepared by the New Zealand process. The product has been found to be stable over a long period of time and settling in containers has been satisfactorily overcome. Suspensions containing 50% Colloidal Sulphur can be prepared, and because of low dosage necessary, and reasonable manufacturing costs, the product has been found economical to market.

In some countries confusion has been caused by the marketing of comparatively coarse dispersions of aggregated precipitated sulphur, coarse-

ly dispersed sulphur prepared by emulsifying techniques, and poorly ground sulphur pastes, as "Colloidal Sulphur." Such products have considerably less surface area per unit weight when compared with truly colloidal suspensions of the New Zealand type.

The N. Z. Process

DURING 1948 an improved process for manufacture of Colloidal Sulphur was developed at the works and laboratory of the Fruit-growers Chemical Co., Ltd., replacing the costly process formerly used for many years. It is thought concentrated colloidal suspensions of sulphur can now be produced in large commercial quantities with unprecedented economy. The cost of reducing sulphur to the colloidal suspension state, per pound, under most favorable conditions, approaches the cost of air-milling sulphur to an average particle size of about 5 microns. Comparatively, the surface area of the Colloidal suspension per sulphur unit weight

is about ten times that of the air-milled sulphur. The plant is compact, and inexpensive to operate and install. Cost of power and auxiliary chemicals are very low. The labor requirement in the reduction plant is unusually small, one operator being in attendance while the equipment is producing.

A large manufacturing unit is not essential for economical production of Colloidal Sulphur suspension. For any country where there are scattered but extensive fruit growing areas, the New Zealand Colloidal Sulphur process is suitable for use of small manufacturing plants designed to meet local demand, in the same way as small units are employed for the preparation of lime-sulphur solution. Nevertheless, large scale manufacturing units may have advantages inasmuch as the comparatively low dosage rates necessitate the transportation of less manufactured tonnage.

It is expected the process developed at Port Mapua will have many applications, including the

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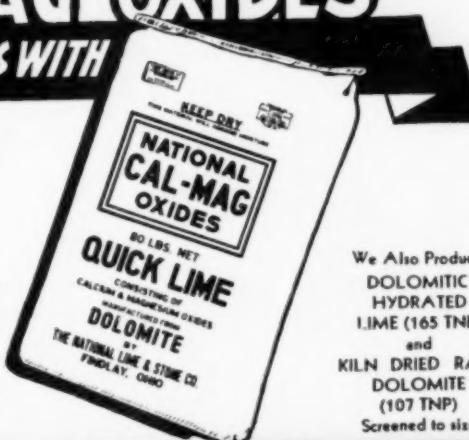
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treatment of other suitable spray-chemicals. Experimental production of DDT colloidal suspension, containing 50% Technical DDT, without solid mineral fillers or solvents, has begun. It is thought this product may be an alternative for wettable DDT powders for some applications, but it has not yet been clearly demonstrated that an extremely fine state of dispersion is advantageous.

The writer wishes to acknowledge assistance given by R. T. J.

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Blick, Cawthron Institute, Nelson; and G. G. Taylor, Plant Diseases Division, Scientific & Industrial Research Department, Auckland, for their cooperation.

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AGRICULTURAL CHEMICALS

Cushman Named V-P

Donald S. Cushman has been made vice-president in charge of sales by Innis, Speiden & Co., New York, it has been announced by W. H. Shefield, Jr., president of the company.

FUNGICIDES

(Continued from Page 63)

That the fungicide weathers away very quickly after the seeds are planted is evident from the fact that no instance has ever been reported where treatment interfered with inoculation. It has not been possible to show in any of the tests conducted in Alabama that any of the protectants used hastens germination or increases the vigor of the plants. In some tests yield records were obtained, but there was no evidence that the yield per plant was influenced by the use of any of the protectants.

All the available evidence at present indicates that the only value of the protectant is the prevention of seed rot after planting, which in turn results in better stands.

Summary: During the 6-year period 1944 to 1949, most of the commercially available seed protectants were tested for their value in improving the emergence of runner peanuts. The need for seed treatment is much greater with machine-shelled seed than with the hand-shelled variety. Machine-shelled seed is practically as good as hand-shelled if it is treated with a suitable seed protectant prior to planting. The best emergence usually was obtained from seed treated with 2% "Ceresan" or "Ceresan M." Over-dosage with mercurial treatments decreases emergence below that of untreated seed. Treatment of seed with more than the recommended dosage of "Dow 9B," "Spergon," "Arasan," or "Phygon" did not have any appreciable ill-effect on the seed. The response to seed treatment varied with varying climatic conditions. Seed treatment was very effective in 1946 and in 1949. In 1947, treatment did not increase emergence appreciably. Specificity of fungicides was evident from the fact that in 1947, "Spergon" was less effective than "Dow 9B," "Arasan," or

"Ceresan M," but in 1949 it was more effective than any of these. A similar trend was evident with "Dow 9B." Seed shelled and treated the middle of February germinated as well when planted in mid-April as those seeds shelled and treated one day before planting. The principal value of seed treatment is in the prevention of seed rot between the time of planting and germination. The value of seed treatment for the control of seed-borne diseases is doubtful.

ANTI-FERTILIZER

(Continued from Page 91)

should be on their guard for this detailed piece of evidence from British research for it may well be "borrowed" by the American anti-fertilizer school.

Earthworm Foe?

THE indictment that fertilizers drive away earthworms is powerfully pressed. It is true, of course,

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KEEP more on... use

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that the worm is a useful fertility worker, a scavenger of organic matter and a preparer of humus. The richer the humus content of a soil, generally speaking, the greater the earthworm population. It is also true that worms are inhibited by soil acidity, and some fertilizer firms recommend the regular use of sulphate of ammonia as an anti-worm measure for lawns. This fact the all-humus crusaders have seized upon gleefully—how, they say, can we have it both ways? We admit that fertilizers drive away worms! But, of course, we can have it both ways, for when worms are desired—which is not the case in lawns owing to the cast nuisance—liming should accompany the use of sulphate of ammonia to compensate for the acidifying tendencies of this fertilizer. And, as has been shown at a British research station for sports-grasses, the use of an alkaline nitrogenous fertilizer (ammonium nitrate plus calcium carbonate) considerably increased the number of worm-casts per square yard; so, too, did the use of sulphate of ammonia when lime was also occasionally used. It has also been shown at the Rothamsted research station that plots which have received fertilizers continuously for a century and plots which have not been fertilized contain about the same population of worms, but the worms in the fertilizer plots weighed much more because they were larger and fatter.

It is this kind of pro-fertilizer information that is needed in *non-technical presentation* to drive the anti-fertilizer schools out of circulation. There is an abundant wealth of solid and suitable evidence—why shouldn't the layman hear about it? He is getting plenty of one-sided information from the other side. As Dr. Ogg, the Director of Rothamsted Experiment Station, stated recently at Dundee, "the propagation of unfounded beliefs about the harmful effects of fertilizers is detrimental to the interests of the whole community." Some of the British soil scientists are getting tough with the anti-fertilizer crusaders—let the information services of the fertilizer industry start getting tough as well! ★★

INSECTICIDES

(Continued from Page 55)

in the hands of dealers and distributors and the establishment of a rather unattractive price have certainly contributed to the current shortage. The price of the acid had fallen from a previous high of 75c to a current low of 43c lb. which has made it appear inadvisable for most 2,4-D producers to put into this product their scarce supplies of phenol and chlorine. Thus,

2,4-D acid suffered double jeopardy from this unfavorable price situation as well as from an increase in demand.

A lowering supply of pyrethrum is continuing to reflect the stepped-up demand due to a shift towards non-toxic materials, as well as a significant increase in its use in household aerosol products. The price situation stays about the same and will probably remain at the increased level for the next season. Continued work on allethrin indicates

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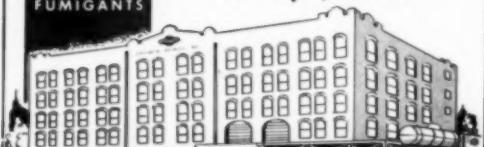
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that the material may be rather disappointing as a substitute for the natural pyrethrins, but this year should see increasing activity in demonstrational field uses. Commercial quantities of allethrin are beginning to move, both as the technical product and in formulations. It is known that many tests will be made to evaluate the material for agricultural insect control during the coming season. ★★

TOMATO INSECTS

(Continued from Page 31)

mental areas was the leaf miner. This insect made its appearance both at Woodland and at Patterson. The seasonal population trends of the insect were followed in all treatments and in none of them did it reach a destructive level. The miner appeared to be as abundant in the check plots as in any treatment. Some evidence was obtained which indicated that 10 per cent toxaphene dust may have

exerted a slight controlling action. However, if present at all, it appeared that it was not sufficient to control the leaf miner should a serious infestation be encountered.

Based upon the past season's investigations, it appears that environmental factors are much more important in regulating the abundance of the leaf miner than are any of the insecticides used. At Woodland the leaf miner was relatively common in one of the check plots, but was difficult to find in any of the treated plots or in the other check which was located at the opposite end of the field. Although the surrounding area was examined, the ecological factors favoring the infestation in the check plot could not be ascertained. Whatever the source, the leaf miner spread through the check plot and into the adjacent treatment area. Later infestations developed in the other check and throughout the treatments, but the area of the original infestation remained the heaviest throughout the season.

Other observations were made which also showed that when environmental conditions are favorable, severe infestations of the leaf miner may occur and that the application of DDT or DDD is not necessary for this to occur. It is certain that if the leaf miner should become an important pest, it will have to be thoroughly investigated from an ecological point of view.

Judging from the seasonal population trends in the experimental plots at Woodland and Patterson, it would appear that from the first of July to the end of the season there is time for this pest to pass through at least 5 generations. Except for the check plot at Woodland, the leaf miner population was extremely small until the latter part of August. From this time on, it increased rather rapidly and the largest populations were encountered during the latter part of September and the first of October. Late in the season, it was observed that tomato plants in good foliage were more heavily infested and of-

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fered an environment much more favorable for the activity of the miner than did plants that were less vigorous.

Based upon the results of the 1949 season, it appears that little damage from the leaf miner is likely to occur if it is not well established in tomato fields by the latter part of August. However, if ecological conditions are such that the pest can become well established in the early season, there is danger that the population will increase to such a level that by midsummer, defoliation may progress to a point where serious sunburning of the fruit may occur.

Summary and Conclusions

THE use of DDT and DDD in the tomato insect control program in northern California during 1949 resulted in excellent control of caterpillars attacking tomato. As far as could be determined, the use of these insecticides did not result in any serious complications that would tend to restrict their use.

Excellent control was obtained with not more than three properly timed and thoroughly applied treatments. In numerous cases satisfactory control was obtained with two well timed applications.

Because DDD is more effective in controlling the tomato hornworm, *Protoparce sexta* (Johon.) than is DDT, it was used more extensively. This was particularly true in the warmer interior valleys where the tomato hornworm threatens serious damage.

After three years of rather extensive testing, a 10 percent toxaphene dust and a 5 per cent toxaphene-3 per cent DDT dust have both proved promising in controlling caterpillars attacking tomato. For the most part the applications were carefully applied and well timed, and it is felt that before these materials can be too highly recommended, they should receive some further commercial testing. It would be very desirable if some growers would apply one or both of these materials to a portion of their acreage and compare their effectiveness with the better tested chlorinated hydrocarbons.

The importance of thorough application cannot be overemphasized if most effective control is to be obtained. Excellent control should result where 5 per cent DDT or 5 per cent DDD dusts are applied at the rate of 30 pounds to the acre. To insure the control of the tomato mite, *Phyllocoptes destructor* Keifer, these materials should be used in combination with no less than 50 per cent sulfur. If no evidence of the tomato mite is apparent by the first of Sep-

tember, the sulfur can be omitted from dusts applied after this date. A 10 per cent toxaphene dust or a 5 per cent toxaphene, 3 per cent DDT dust should also be used in combination with sulfur applied at the rate of 30 pounds to the acre.

Although the timing of applications will vary somewhat according to the district and season, the following schedule has resulted in very satisfactory control:

July 1 to 15:—Application directed



primarily against the tomato mite, but will also control hornworms and any cutworms present.

August 1 to 20:—Application directed primarily against hornworms and armyworms, but will continue control of the tomato mite.

September 1 to 20:—Application directed primarily against the corn earworm, other cutworms, tomato pinworm, and the potato tuber moth. Will also control hornworms if present.

In the central and southern San Joaquin Valley the above schedule should be put into operation as early as late May or June, and continued as long as there is evidence of pest damage.

In regard to damage by the leaf miner, it appears, that based upon the results obtained in 1949, little injury is likely to occur if the pest is not well established in tomato fields by the latter part of August. However, if ecological conditions are such

that the pest can become well established early in the season, there is danger that the increased population by mid-summer may result in defoliation to a point where serious sunburning of the fruit may occur.

Acknowledgments

* These investigations were made possible through a group of efficient cooperators. Among growers who deserve special mention are Harlan and Dumars of Woodland and Albert Bevis of Patterson. Funds for conducting the investigation were supplied in a large measure by the Canners' League of California and by the Farm Bureau Federation. We wish to thank the following for suggestions and assistance: E. O. Evans, N. B. Akesson, Edward Woyneck, Don Davis, F. E. Stevenson, and Jack Underhill. Thanks are also due to the insecticide companies who furnished material for use in the investigations.

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PETROLEUM SPRAYS

(Continued from Page 40)

up, or absorb, more than a small amount of the crystalline insecticidal solids as compared to the primary petroleum solvents.

To indicate how important temperature is on the solubility of solids in petroleum, it is interesting to note that benzene will dissolve DDT crystals to approximately 42% of its own volume at a temperature of 24°C., but will take up nearly 55% of its own weight in technical grade DDT crystals when the temperature is increased to 48°C.

Other Toxic Factors

THE influence of phytotoxic factors other than the oxidization of the aromatics, must be taken into consideration, although such factors are not the primary subject of this article. For instance, close proximity to salt water will often result in mild foliage burning when excess toxic salts are oxidized on the foliage from sodium chloride in the air.

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sprayer experimental work, the author saw mild foliage burning in Norwalk, Connecticut, close to the salt water, and a complete absence of foliage burning in Danbury, Connecticut, some 20 miles inland from Norwalk, even though the same 6% DDT oil solution was applied in both operations on the same species of deciduous ornamental tree from the same mist-applicator machine by the same operator on the same day.

The author operated a mist-applicator in May of 1947 and sprayed roadside elms in a New England town for several hours during a fine rain using a 5% DDT oil solution with ordinary gas station kerosene as the diluent to bring the basic 30% solution down to the recommended 5%. There was no evidence of any foliage burning.

During 1947 and 1948 when there was much talk about "kerosene burning from mist-sprayers" in New England, New York, and New Jersey, the author checked carefully several reported cases of "kerosene damage" and found, in more than one case, that the spray material used was a DDT emulsion with water as the diluent!

In more than one case, too, it was accurately determined that foliage burning was caused when an operator, using the technique of the hydraulic-sprayer, lingered beneath ornamental trees while he plastered the foliage with gallons, instead of pints, of the spray material; depositing a sufficient amount of the primary solvent to cause foliage burning.

High aromatic content plus oxidization will result in foliage burning, it is true, but when all the reports of "poor evaporation" have been tabulated, one must come to the conclusion that good spraying now, as formerly, is still a matter of a good operator using correct equipment and applying the proper material.

Non-Aromatic Injury

IS there other foliage injury from oil in addition to the acid-burning of the epidermal layer following the oxidization of the unsaturated hydrocarbons? Is there some deeper penetrative injury from unoxidized oils?

A complete discussion of this subject is not possible here, but it is of interest to note that there have been field reports by spray operators indicating a complete lack of foliage burning when DDT oil solutions were applied at night when slight burning had developed after the same oil solution had been used during the daylight hours.

These reports indicate, to some extent, that the injury was not the

typical oxidizing, or searing, injury caused by sun-activated petroleum acids; that the oil solution was less than 2% DDT with consequent small amounts of solvent; that the diluent was an oil with high "UR."

In such cases, was the lack of foliage injury at night due to the fact that the stomata of the leaves were closed, thus barring oil penetration of consequence? Does the night period

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provide the ideal setting for oil spraying with completely-closed leaf surfaces with no open stomata through which oil can enter the internal tissues and cause injury?

Considerable research has been carried out since the early days of horticultural oil spraying on penetrative oil injury to foliage, particularly on the Pacific Coast. Dr. E. T. Bartholomew, Professor (Emeritus) of Plant Physiology, University of California, Citrus Experiment Station, Riverside, has given pertinent information in reply to questions. Says Dr. Bartholomew:

"It would seem to me that there would be very little difference in results with oil sprays whether you applied the spray during the day or at night. The reason for this would be that comparatively small amounts of the oil would evaporate from the surface of the leaves during the night and would be present to enter the stomata upon their opening on the following day."

"One of the men who used to work here at the station, Dr. Ebeling, did some work on that problem years ago. May I quote from a letter which I received from him in answer to your inquiry:

"If the oil were allowed to remain until dawn, it would all get into the leaf and the results would be the same as if it were applied during the day."

"From my work with oil sprays, I have found that the oil will very slowly penetrate the inter-stomatal areas of the cutinized surfaces but the penetration is so slow that I doubt that it would be possible to detect any difference between night and day spraying. Of course, the thinner the cutinized, or waxy, layer, the greater the rapidity of penetration. For this reason, there might be a small difference in the response of different leaves."

Dr. Bartholomew's mentioning "cutinized leaf surfaces" gives rise to the hope that scientific data dealing with the differences in cutin coating among different leaf species and the effect of petroleum oils thereon, will be made increasingly re-available in the future to those working with the mist-application of petroleum sprays.

Petroleum As "Solo Spray"

AS an example of the use of petroleum as petroleum, with intrinsic value and not as a solvent or

carrier, the work of Chapman, Pearce, and Smith, at the New York State Agricultural Experiment Station, Geneva, N. Y., is of importance. In co-operation with the Division of Entomology, Pearce and Smith have made studies of the mode of insecticidal action of petroleum and synthetic hydrocarbons with particular reference to the effect of oil on the respiratory activity of eggs of oil-susceptible species of pests.

In their experimental work, Pearce and Smith found that oil caused a marked reduction in respiratory rate, ultimately destroying the viability of the eggs. They also found that the oil must be present approximately 24 hours to prevent hatching, which, according to a digest of the work in the 1948 report of the Station, would make "highly volatile products ineffective as ovicides."

The petroleum oil used in the Pearce-Smith experiments, by the way, was a water-white paraffinic oil derived from Pennsylvania crude with a "UR" of 98%. In the work recently reported by Chapman and Pearce⁵ using petroleum in the control of red mite, the petroleum used had a "UR" of 92% and was used at 3% strength emulsified with albumin.

Other Specifications

UN SULFONATABLE resin⁶ is not the only petroleum specification having a bearing on the efficacy of sprays. "Distillation range," "viscosity index," "flash point" these factors must be considered when the value of a particular product is being judged for horticultural spraying. However, "viscosity," the "flow rate" or the "gumminess" of a spray oil ranks high as a factor to be considered inasmuch as it is closely involved with the duration of the petroleum on the leaf surface.

Viscosity is generally measured by means of a "viscosimeter" in a test which computes the time, in seconds, required for a given amount (generally 60 cc.) of liquid to pass through a fixed aperture at a temperature of 100° Fahrenheit.

The specifications (previously

cited) for the "superior" dormant oil of the New York State Agricultural Experiment Station call for a Saybolt viscosity of 90-120 seconds. It has been generally agreed upon by agricultural scientists for many years that a petroleum oil with a Saybolt viscosity of less than 55 seconds was of no value as an ovicidal toxicant although it is interesting to note, in the Pearce-Smith report, that the oil which proved to be of high ovicidal value had the Saybolt viscosity of 65 seconds. As a general rule, the dormant oils have a higher viscosity rating than the summer oils. "Acme" white oil, previously mentioned, has a Saybolt 100° viscosity of 80-85 seconds and is used principally for summer foliage spraying.

Conclusion

OVER 25,000,000 gallons of petroleum oil are used annually in outdoor spraying throughout the world since the introduction of the concentrated sprays several years ago. A workable understanding of the nature of petroleum, coupled with prudence and intelligence exercised in its use in outdoor spraying, will mean better control of agricultural pests with the new labor-and-material-saving type of spray equipment and the new low-volume spray concentrates.

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Industry Patents

2,497,628. SPRAY GUN. Patent issued February 14, 1950, to Henrietta M. Norwick, Oakland, California. In a spray gun having a main body provided with a tubular open-ended barrel, a handle extending from the body, a tubular air-conducting member extending through said barrel, an axially movable tubular valve stem telescopically engaged with the tubular member and extending outwardly from one end of the barrel, an extension connected with said barrel at the end thereof through which the tubular valve projects, said extension having therein inlet and outlet passages for fluid, said outlet passage being associated with and adapted to be opened and closed by the tubular valve upon axial movement of the latter, and a trigger for moving said tubular valve in combination with a seal for restraining leakage of liquid from said extension and along said tubular valve comprising a closure member having a bore therein slidably receiving said tubular valve and secured in an end of said barrel, a plug member secured in said extension coaxially with and having therein a bore through which the tubular valve extends and is slideable, said plug member having therein an annular recess concentric with and surrounding said tubular valve, said recess having an open end facing the closure member of said barrel, compressible packing material in said recess, and means for releasably securing said extension to the end of said barrel whereby said closure member overlies and closes the open end of said recess.

2,499,021. SPRAY NOZZLE. Patent issued February 28, 1950, to Lynn Fletcher, Lowell, Mich., assignor to Lowell Specialty Co., Lowell, Mich. In a sprayer for insecticides and the like having a liquid reservoir and means for subjecting liquid in said reservoir to air under pressure and for supplying air under pressure to a nozzle, a spray nozzle comprising, a relatively fixed nozzle head holder having a smooth cylindrical bore, a nozzle head member rotatably and slidably disposed in the bore of said holder and having a bore and a spray outlet orifice from the bore, a liquid supply tube secured relative to said holder and having its delivery end disposed in said head member bore and slidably fitting therein for movements of the head member longitudinally of the axis of the tube, said tube delivery end having an aperture through the wall thereof for the admission of air into said tube, a spring abutment on said tube, a spring means abutting said abutment and said head member and normally tending to move said head member longitudinally of the tube axis, said holder having an arcuate slot extending through one side thereof transversely of its bore, said slot having components of direction both

longitudinally and circumferentially of said bore of said holder, and a manually engageable pin secured to said head member and extending through said slot for moving said head member in said holder bore against the action of said spring from one end of said slot to the other, said aperture in said tube being so located that it is disposed within said head member bore when the said pin is at one end of said slot and without said head member bore when said pin is at the end of said slot.

2,499,092. FOG NOZZLE. Patent issued February 28, 1950, to T. W. Burnam, Whittier, Calif., assignor to Fog Nozzle Co., Los Angeles, Calif. An internal impingement fog nozzle which includes a nozzle body having a head with a plurality of converging orifices in said head, said orifices converging in the direction of the exterior of the head and partially within and partially outside the head, and a circular counterbore extending inwardly from the outer face of the head meeting the orifices at their points of intersection to provide a substantially circular discharge bore for the nozzle, said counterbore forming a substantially flat base connecting said orifices, and an orifice axially aligned with the counterbore communicating with said flat base, said latter orifice being smaller in diameter than the converging orifices.

2,506,636. INSECTICIDAL DUSTS CONTAINING 2,2-BIS (4-METHOXYPHENYL)-1,1-TRICHLOROETHANE AND PROCESS FOR MAKING SAME. Patent issued May 9, 1950, to Albert L. Flenner, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington. In a process for the manufacture of a solid particulate dispersed system containing essentially 2,2-bis (4-methoxyphenyl)-1,1-trichloroethane and an adsorbent powder, the particles of said dispersed system having an average size less than about 5 microns, the steps comprising suspending an intimate particulate solid mixture of d(methoxyphenyl) trichloroethane and an adsorbent powder in a high velocity gas stream and pulverizing mixture therein to an average particle size less than about 5 microns by impact and attrition of the suspended particles against one another and against retaining surfaces.

2,507,207. INSECTICIDE COMPRISING CYCLO-DIENE QUINONE ADDUCTS. Patent issued May 9, to Julius Hyman, Denver, Colo. An insecticidal composition comprising an adduct of a hydrogenated quinone and a conjugated cyclic diene, distended in a carrier dust.

2,507,208. COMPOSITIONS COMPRISING HALOGENATED CYCLO-DIENE QUINONE ADDUCTS. Patent issued May 9,

to Julius Hyman, Denver, Colo. The product obtained by chlorinating an adduct resulting from the addition of two mols of cyclopentadiene to one mol of benzoquinone dissolved in carbon tetrachloride at temperatures below 10° until the system no longer gains in weight.

2,506,635. DDT INSECTICIDE DUST AND PROCESS FOR MAKING SAME. Patent issued May 9, to Albert L. Flenner, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington. In a process for the manufacture of a solid particulate dispersed system containing essentially technical DDT and an adsorbent powder, the step comprising pulverizing an intimate particulate solid mixture of technical DDT and an adsorbent powder by attrition and impact to an average particle size less than 5 microns by suspending and buffeting the mixture in a high velocity gas stream.

Trade Mark Applications

WEED-EATH. in outline capital and lower case letters, for preparation for destroying or killing obnoxious thistles or weeds, including Canada thistles, dandelions, poison oak, poison ivy, ragweed, plantain, mustard, dock, wild morning glories, mallow and other weeds. Filed Jan. 9, 1947, by Howard Hanson & Co., Rockton, Ill. Claims use since Jan. 4, 1946.

SASCO. in heavy capital letters, for sulfur in powder form used for agricultural dusting as an insecticide and fungicide. Filed Mar. 26, 1949, by Southern Acid & Sulphur Co., Inc., St. Louis, Mo., assignor to Mathieson Chemical Corp., New York. Claims use since August, 1940.

WHITE DIAMOND. in diamond-shaped design, for insecticides and fungicides. Filed Mar. 26, 1949, by Southern Acid & Sulphur Co., Inc., St. Louis, Mo., assignor to Mathieson Chemical Corp., New York. Claims use since 1944.

BON SOIR BUG. in capital letters, for insecticides. Filed June 7, 1949, by Bon Soir Bug Co., Inc., Opelousas, La. Claims use since May 3, 1949.

SILIKILL. in hand-lettered caps and lower case, for insect-killing compound. Filed June 15, 1949, by Waxed Silicone Products, Inc., Miami, Fla. Claims use since Aug. 1, 1948.

ROSEMASTER. in small capital letters, for chemical composition for use as a pesticide for ornamental shrubs and flowers. Filed originally, under act of 1909, Feb. 26, 1947; amended to application under act of 1946, Principal Register, Dec. 21, 1949, by Michigan Chemical Corp., Saint Louis, Mich. Claims use since Jan. 31, 1947.

ENS-ZEM. in heavy capital letters, for insecticides. Filed Aug. 25, 1947, by Stauffer Chemical Co., San Francisco, Calif. Claims use since Dec. 3, 1940.

Classified Advertising

Rates for classified advertisements are ten cents per word, \$2.00 minimum, except those of individuals seeking employment where the rate is five cents per word, \$1.00 minimum. Address all replies to Classified Advertising with Box Number, care of AGRICULTURAL CHEMICALS, 254 W. 31st St., New York 1. Closing date: 23rd of preceding month.

Positions Open:

Salesman Wanted: By well known feed manufacturer to sell vitamin dry products and oils in protected territories. Man with established feed trade clientele will find this a lucrative sideline. Address Box No. 438, care of Agricultural Chemicals.

Technical Field Service Representative: Experienced entomology-pathology to arrange and follow up experiment station and field tests on new products. Also sales training and dealer meetings in off-season. Practical field experience necessary. Address Box No. 439, care of Agricultural Chemicals.

Chemical Salesman: With university, agricultural degree for the sale and promotion of a large manufacturer in the Northern California area. Address Box No. 440, care of Agricultural Chemicals.

Agricultural Chemical Salesman—Midwest with technical training background of entomology, agronomy, or related fields. Excellent opportunity with leading agricultural chemical manufacturer. Address Box 441, care of Agricultural Chemicals.

Positions Wanted:

Plant Pathologist: Ph. D.; experience in research and administration. Background in plant physiology and herbicides. Desires position in East or Midwest. Address Box No. 441, care of Agricultural Chemicals.

Agriculturist: Desires position with firm in export of agricultural chemicals, seeds or allied lines. Former resident Mexico with travels within Republic and Central America. Have contacts through handling exports of agricultural commodities from U.S.A. and Europe. Speak and write Spanish. Address Box No. 442, care of Agricultural Chemicals.

For Sale:

For Sale: TIFA fog applicator. Used very little. Will sell at sacrifice. Located Portland, Oregon. For details and price, write to Box No. 443, care of Agricultural Chemicals.

For Sale: Illness forces sale of industrial cleaning chemicals produced by leading manufacturers—excellent condition. Inventory value approx. \$15,000. Cash preferred—terms with reputable firm. Chemway Co., 111 W. Main, Walla Walla, Wash.

ALVIN J. COX, Ph.D. Chemical Engineer and Chemist

(Formerly Director of Science, Government of the Philippine Islands. Retired Chief, Bureau of Chemistry, State of California, Department of Agriculture.)

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of the earth practically every type of fertilizer raw material for distribution to fertilizer manufacturers.

Today, in addition to fertilizer materials, the firm handles feeding materials, packing house by-products, fishery by-products and several chemical and pharmaceutical specialties.

New Plant for Calspray

California Spray Chemical Corp. has announced a new district office and manufacturing location at 326 Fennville St., Fennville, Michigan. The new facilities will occupy some 26,000 square feet of space, and will produce lime sulfur solutions and dust materials for growers in the vicinity. Charles E. Brian is District Manager.

Monsanto Names Saunders

Monsanto Chemical Co., has announced that Dr. James H. Saunders has been made group leader in the research department of the company's phosphate division at Anniston, Alabama. Dr. Saunders is a native of Kentucky, and holds degrees from the University of Kentucky and the University of Illinois.

AGRICULTURAL CHEMICALS

To Nat'l Tech. Lab. Post

George D. Butler has been appointed to the staff of National Tech-



GEORGE D. BUTLER

nical laboratories in New York, the company has announced. Mr. Butler was formerly connected with the Calco Division of American Cyanamid Co. as a physicist in instrumentation research.

AEPCO Issues 1949 Report

The Association of Economic Poisons Control Officials has issued its second annual report, containing the talks and committee reports given at the Association's meeting held in October in Washington. Officers of the group are J. E. Fudge, College Station, Texas, president; A. B. Lemmon, Sacramento, Calif., vice-president; and A. B. Heagy, College Park, Md., secretary-treasurer.

Babbage to Central Chem.

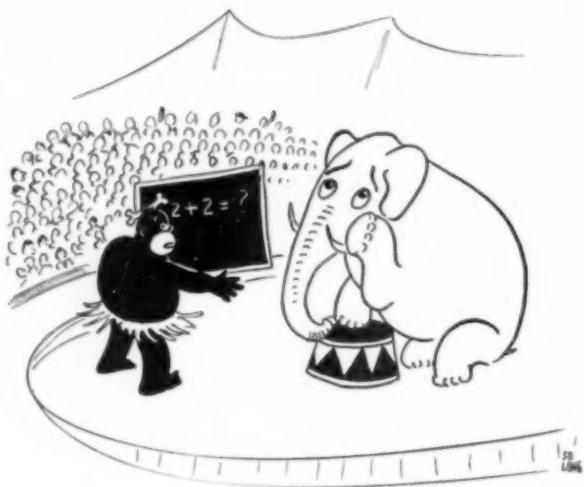
Central Chemical Corp., Hagerstown, Md., has announced the appointment of John Babbage, formerly of the Agricultural Chemical Division of the Sherwin-Williams Co., as general manager of Central's Harrisonburg and Crimora, Va. plants and in charge of Virginia sales. Mr. Babbage is a graduate of the University of Illinois and was in the agricultural chemical division of Sherwin-Williams for 24 years. He was manager of the S-W eastern zone for many years.

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AGRICULTURAL CHEMICALS

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TALE ENDS

ALTHOUGH the U.S.D.A. fertilizer consumption report for the year ended June 30, 1949 (see pages 32, 33, 34, 35, 36, and 37) shows a 4.1% increase in the use of fertilizer, reports for the months since mid-1949 indicate that the industry's sales curve has turned downward. The falling prices of some farm products, and the uncertainty in government circles as to just what is to be done about various price support programs are credited with responsibility for the drop in sales, which is becoming a matter of increasing concern to fertilizer manufacturers.

American fliers have been accused by the Russian dominated press of Eastern Germany of dropping potato bugs on potato vines in the Russian area. It was reported that the insects first appeared in the area soon after an American airplane flew over. American airmen, told of the report took it as a huge joke, remarking the Soviets had missed a bet in not accusing the Yanks of hand-painting each insect so that the dots might be some dark plot to remind the iron-curtain inhabitants of the four freedoms . . . one dot for each freedom.

An executive connected with a well known fertilizer raw material concern has recently been conducting a little private investigation of his own into the propaganda mill back of "organic farming." A number of his field men were detailed to interview farmers who had contributed glowing testimonials on the superiority of the strictly organic approach to crop nutrition. In almost every case, he reports, the successful "organic farmers" turned out to be obscure "back-yard" gardeners who worked at some other job by day and tossed around the compost only of an evening. In almost every case, the field men reported, those interviewed had but a meager knowledge of plant nutrition, but were blindly and in many cases fanatically prejudiced against the use of "chemicals" on plants.

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Cal-Nitro* is high in nitrogen—with a guaranteed nitrogen content of 20.5%. It supplies crops the nitrogen they need—at *low cost*.

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Cal-Nitro has half nitrate nitrogen and half ammonia nitrogen. Both forms are quick-acting. The ammonia form is long-lasting, since it resists leaching.

ESSENTIAL PLANT FOODS

Cal-Nitro also contains Calcium and Magnesium—plant foods which are essential for vigorous growth.

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SYNTHETIC NITROGEN PRODUCTS CORP.
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For CORN



For COTTON



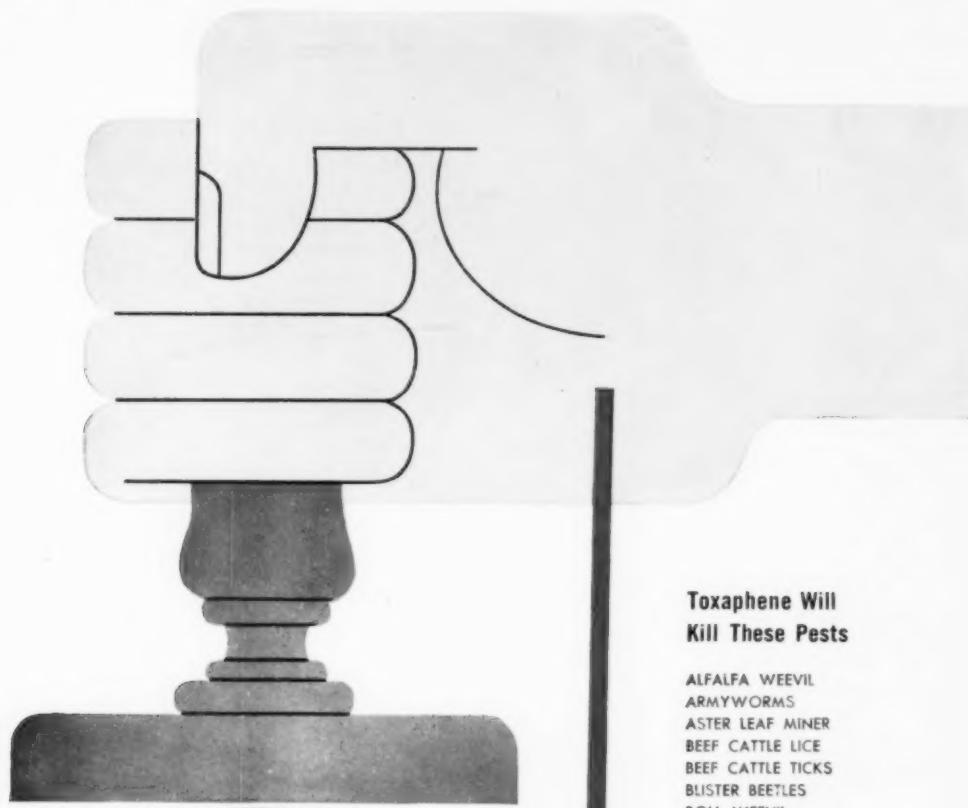
For SMALL GRAINS



For PASTURES



* The Synthetic Nitrogen Products Corporation owns the trademark "Cal-Nitro," which is used to designate a nitrogen fertilizer compound.



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MAKERS OF TECHNICAL TOXAPHENE FOR AGRICULTURAL INSECTICIDES



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